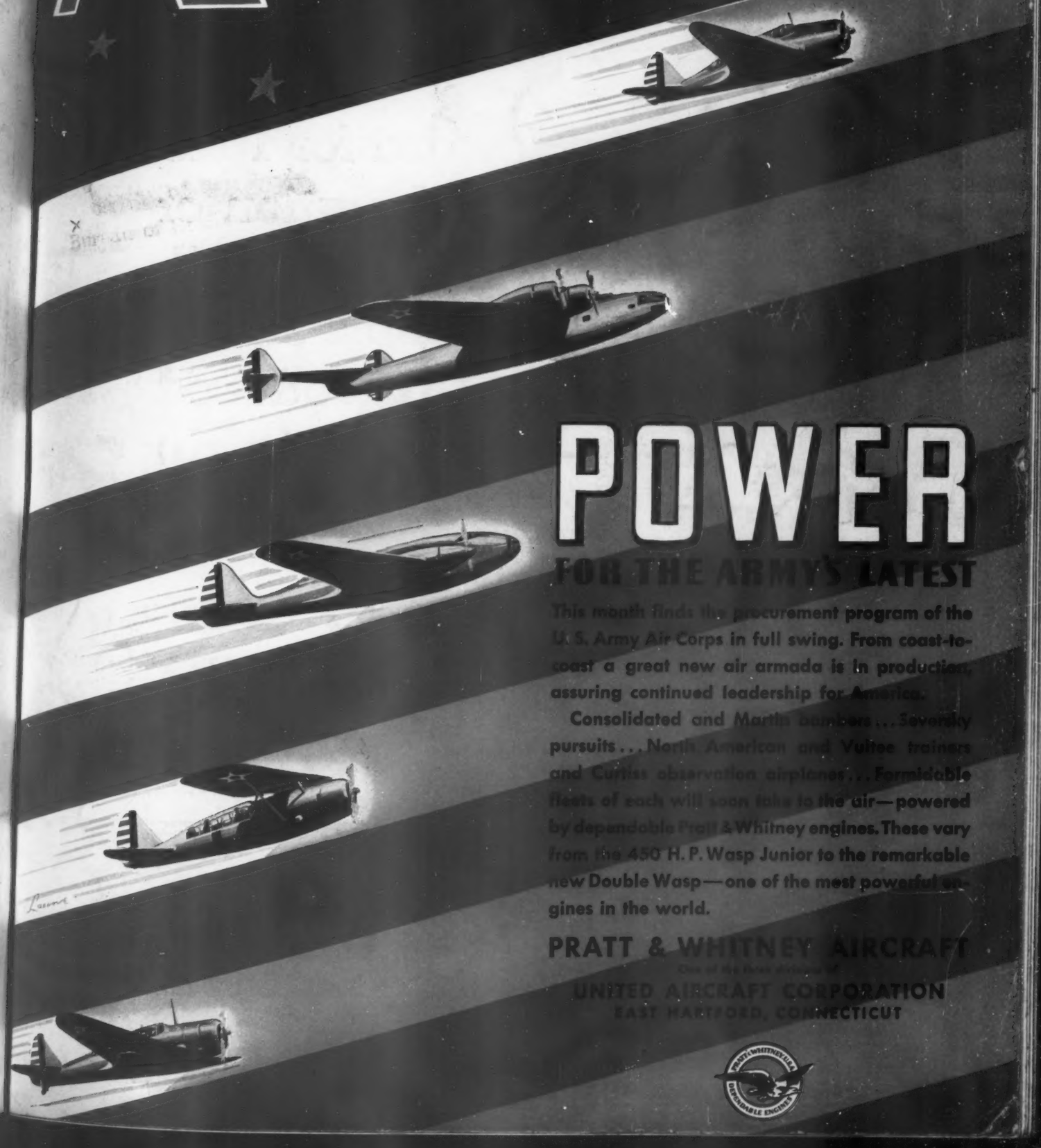
McGraw-Hill Publishing Company, Inc. NOVEMBER, 1939 Price 35c. per copy

AVIATION

The Oldest American Aeronautical Magazine



POWER

FOR THE ARMY'S LATEST

This month finds the procurement program of the U. S. Army Air Corps in full swing. From coast-to-coast a great new air armada is in production, assuring continued leadership for America.

Consolidated and Martin bombers . . . Seversky pursuits . . . North American and Vultee trainers and Curtiss observation airplanes . . . Formidable fleets of each will soon take to the air—powered by dependable Pratt & Whitney engines. These vary from the 450 H. P. Wasp Junior to the remarkable new Double Wasp—one of the most powerful engines in the world.

PRATT & WHITNEY AIRCRAFT

Division of the United Aircraft Corporation

EAST HARTFORD, CONNECTICUT

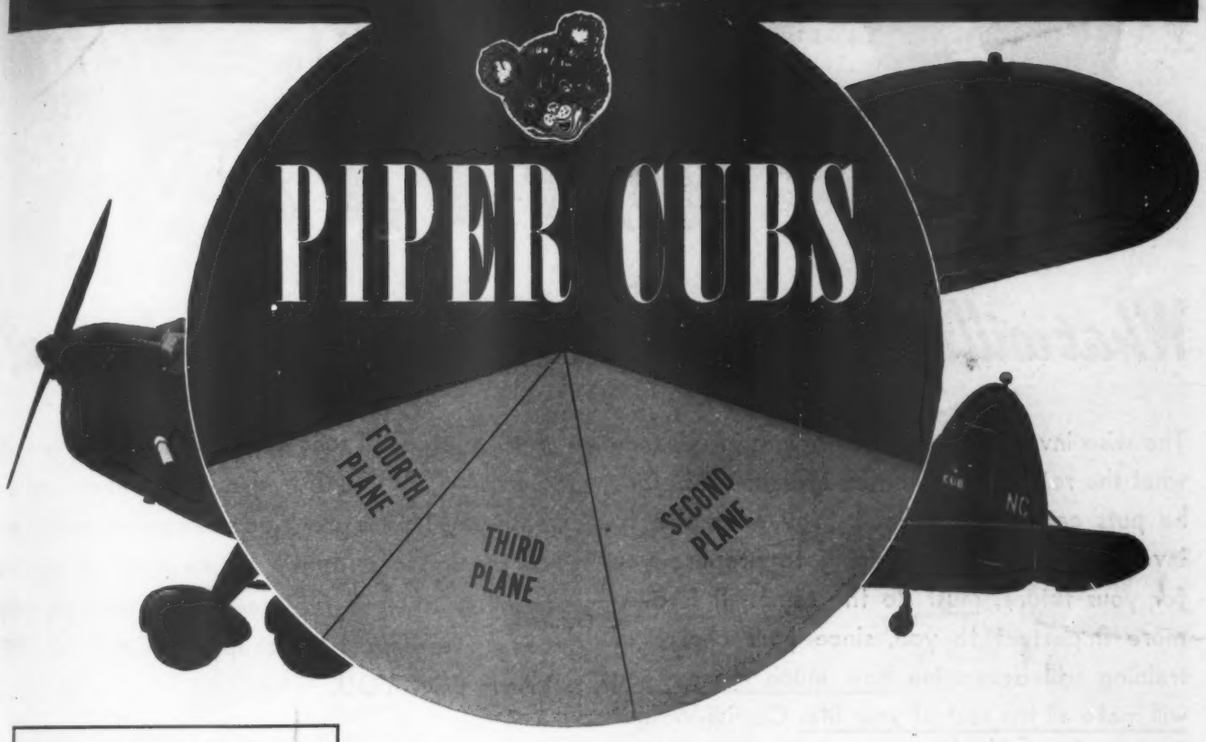
The New Howard for 1940 is the best combination of speed, load carrying ability and comfortable stability in flight so far produced in the 4–5 place cabin class.

● Send For A Copy of The Aircrafter Which Tells All About The Top 4–5 Place Airplane of The Year.

Howard AIRCRAFT CORP.

5303 WEST 65TH STREET, CHICAGO, ILL., U.S.A.

Do You Know That You Are Buying More Cubs Than All Other Light Planes Combined?



Free Flying Course

The authorized Cub Dealer from whom you buy your new Piper Cub will arrange for you to receive a course of dual flight instruction in your own new plane by a government licensed instructor without charge.

Free Demonstration

Your Cub Dealer will be glad to give you a free trial flight. There are Piper Cub Dealers at all leading airports. No obligation.

New Catalog Free

Send today for new Cub catalog, details of the free flying course and name of your Cub Dealer. Piper Aircraft Corporation, 119 A Street, Lock Haven, Pa., U.S.A. . . . Cub Aircraft Company, Ltd., Copenhagen, Denmark.

DURING the first nine months of this year more Piper Cubs were purchased than all other light planes combined! And Cub unit sales represented approximately 60% of the total of the four leaders! Why this overwhelming preference? Because a Cub-invested dollar gives you a combination of superior performance, greater power, faster take-off, easier landing, more comfort, greater safety, finer appearance and longer mileage than any other plane-invested dollar—bar none! . . . Piper Cub models include Continental 40 h.p. Trainer at $1098 (only $366 down), Franklin or Lycoming 50 h.p. Trainer at $1298, Continental 50 h.p. Trainer at $1450, Lycoming 65 h.p. Coupe at $1910 and Continental 65 h.p. Coupe at $1995. All prices F.A.F. Lock Haven, Pennsylvania.

Visit Us at the San Francisco Fair and the Cub Factory

COUNT THE CUBS THE WORLD'S FASTEST SELLING AIRPLANE

Published monthly, price 35c a copy. Subscription rates—United States, Canada, Mexico and Central American Countries, $3.00 a year. All other countries, $5.00 a year or 30 shillings. Entered as second-class matter, September 3, 1936, at the Post Office, Albany, N. Y., under the Act of March 3, 1879. Volume 38, Number 11.

YOU...

What will Curtiss-Wright Tech training do for you?

The wise investor always determines in advance what the return will be on his investment before he puts cash "on the line". You, who plan to invest in a course of training to prepare you for your future, must do the same. It is even more important to you, since your choice of training will determine how much money you will make all the rest of your life. Curtiss-Wright Tech career training is carefully designed to do just one thing—MAKE MONEY FOR YOU, and for all other Curtiss-Wright Tech graduates.

Our hundreds of successful graduates prove that Curtiss-Wright Tech training gets results and always pays. It has provided them with a profitable occupation and secure future since it trained them in advance for the highest position they could ever expect to occupy. IT CAN DO THE SAME FOR YOU.

We invite your consideration, investigation and comparison. The handy coupon will bring you full details. Use it.

CURTISS WRIGHT TECHNICAL INSTITUTE

UNDER PERSONAL SUPERVISION OF MAJOR C. C. MOSELEY SINCE ITS ESTABLISHMENT IN 1929

GRAND CENTRAL AIR TERMINAL • 1226 AIRWAY
GLENDALE (LOS ANGELES) CALIFORNIA

Offering specialized and proven training in

Aeronautical Engineering & Master Mechanics

MAIL THIS HANDY COUPON TODAY!

Without cost or obligation send me full information and catalog on the course checked below.

Major Career Courses	*Supplementary Courses*	*Home Study Courses*
◯ MASTER AVIATION MECHANIC	◯ AIRCRAFT SHEET METAL	◯ BLUE PRINT READING
◯ AERONAUTICAL ENGINEERING	◯ POST GRADUATE ENGINEERING	◯ AERONAUTICAL DRAFTING

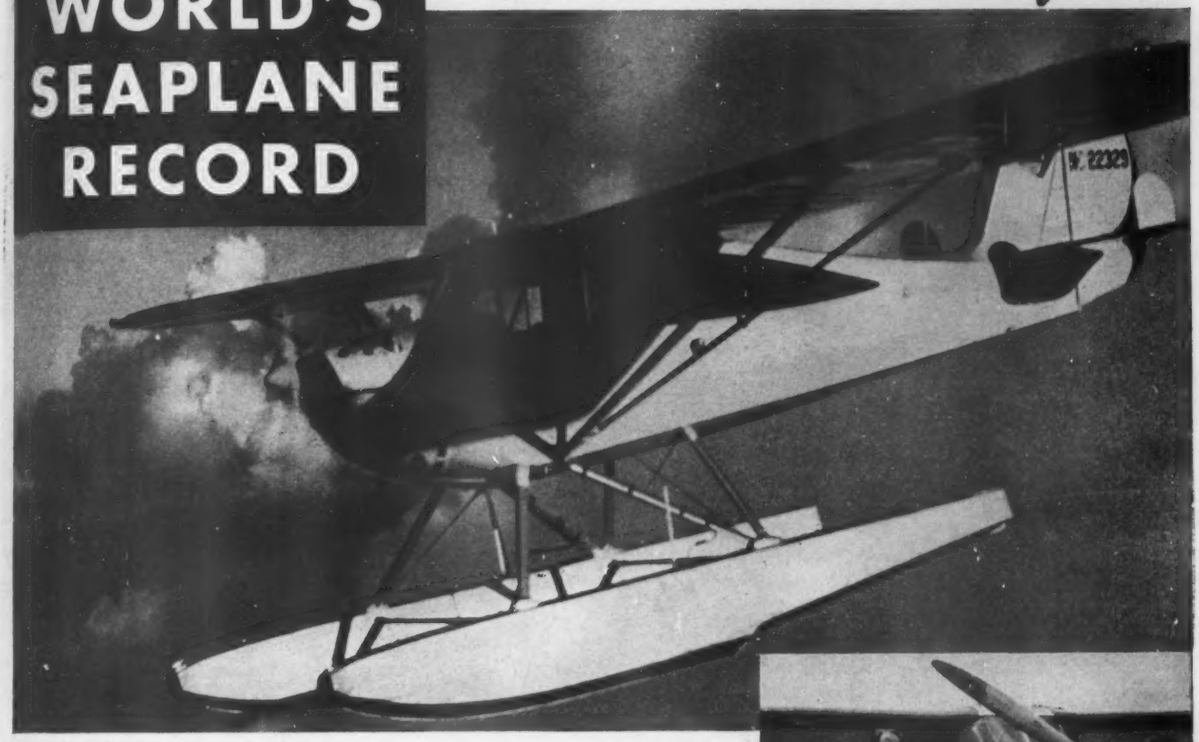
NAME_____ Age____ Date I Plan to Enroll_____

AV-11

ADDRESS_____ City_____ State_____

NEW WORLD'S SEAPLANE RECORD

NEW YORK TO NEW ORLEANS
Non-Stop — Non-Refueling in the Aeronca "Chief"



WORLD'S *Champion* OF LAND AND SEA

Here are the Facts:

PILOT—HENRY CHAPMAN. **SHIP**—AERONCA "Chief" 65 Continental Powered Seaplane. **TAKE OFF**—Oct. 12, 6 A. M. E. S. T. NEW YORK CITY. **LANDING**—6:30 P. M. C. S. T. NEW ORLEANS. **DISTANCE**—1186 MILES. **TIME**—13½ HRS. **AV. SPEED**—88 M. P. H.

Aeronca does it again! First in the air—land or sea. Holder of the world's land light plane distance record made by Johnny Jones in his sensational coast-to-coast non-stop, non-refueling flight—and, now, the important seaplane record. Here's proof of Aeronca's engineered stamina and flyability—proof of superior craftsmanship and performance which has won the favor of so many leading operators and sportsman flying enthusiasts. Aeronca's the choice—wherever you go.

Congratulations Henry Chapman on Your Sensational Record Flight

District Manager for Aeronca at New Orleans, Henry Chapman gets the praise and plaudits of everybody associated with the Aeronca organization and the aviation industry. His great ability and far-sightedness is typical of all Aeronca men—the willingness to help establish facts by flights that prove the dependability of low-cost flying.

THE "*Chief*" TOPS THEM ALL

By comparison the "Chief" is the "Best Buy"—beauty, craftsmanship, performance, economy—everything to win your favor. PRICES ARE LOW. Aeroncas deliver as low as $430 DOWN—Easy pay plans. Send for free literature today!

THE PROVEN CHAMPION
AERONCA
MOST FOR YOUR MONEY

AERONAUTICAL CORP. OF AMERICA • H-11 Lunken Airport • CINCINNATI, O.

Cable Address
AERONCA U. S. A.

Exclusive Export Agents
AVIATION EQUIPMENT AND EXPORT, INC.
25 Beaver St. New York City

LOOKING AHEAD WITH THE NAVY

Superbly manned and equipped, the Flying Forces of the Fleet stand ready... an eloquent result of far-sighted preparation. For over twenty years the personnel of Vought-Sikorsky Aircraft has done its part... building better and better airplanes to meet the increasingly rigid demands of National Defense. Latest of these... the OS2U-1... is now in quantity production. Meanwhile, on the drafting boards, even finer Vought-Sikorskys are coming up.

VOUGHT-SIKORSKY AIRCRAFT

STRATFORD, CONNECTICUT

ONE OF THE THREE DIVISIONS OF UNITED AIRCRAFT CORPORATION

There is no Substitute for EXPERIENCE

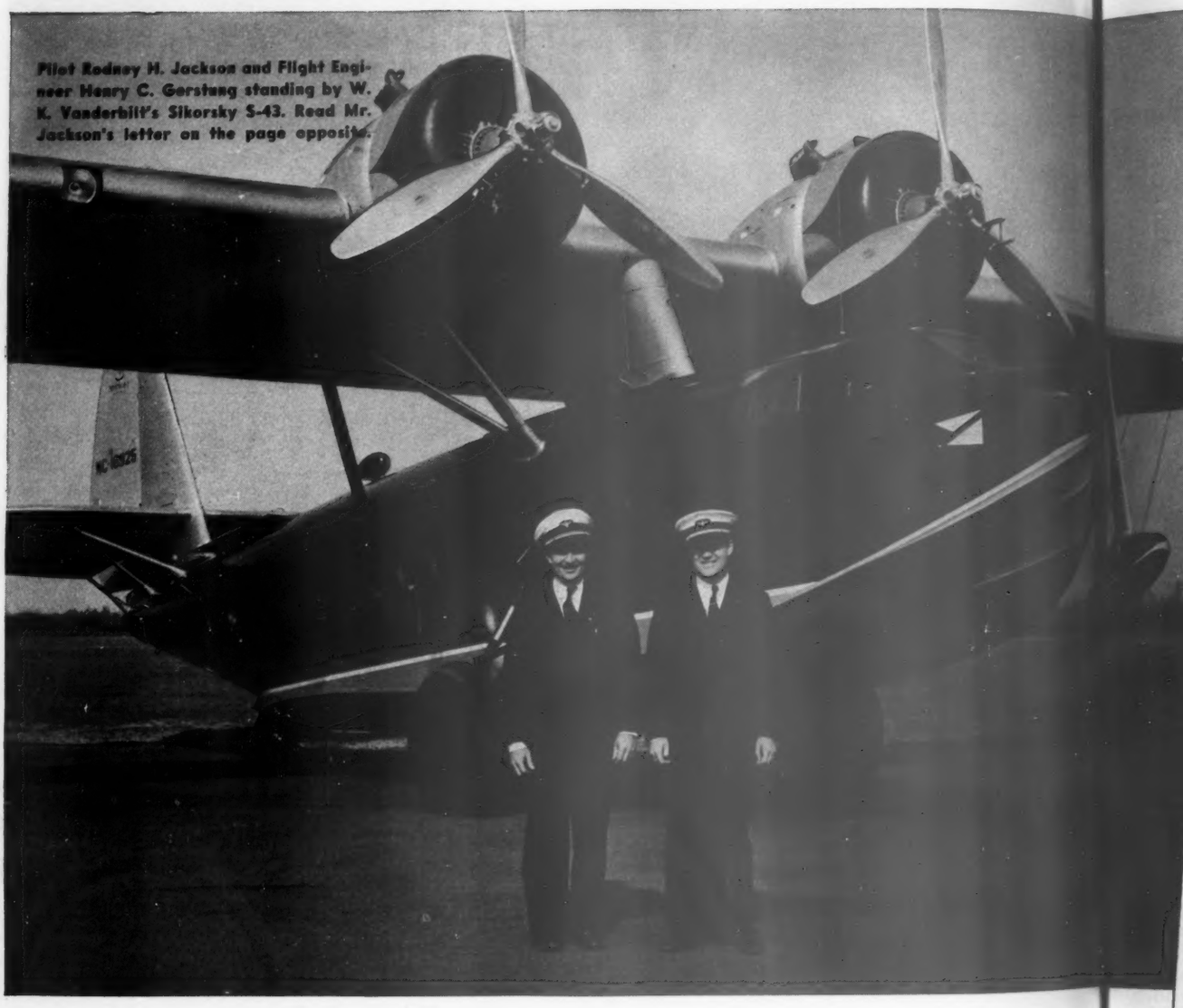
IN MANUFACTURING highly specialized precision products, such as New Departure ball bearings, there is no short-cut to the knowledge and skill gained by long years of experience. The superiority of the methods, materials and the products which result from New Departure's fifty years of manufacturing experience are recognized wherever bearings are used. New Departure, Division of General Motors, Bristol, Connecticut.

2827

NEW DEPARTURE

THE *FORGED STEEL* BEARING

READY FOR IM



Pilot Rodney H. Jackson and Flight Engineer Henry C. Gerstung standing by W. K. Vanderbilt's Sikorsky S-43. Read Mr. Jackson's letter on the page opposite.

WITHIN THE U. S. and to other countries, more scheduled airline mileage is flown with Texaco than with any other brand.

Experienced aviation engineers, trained in the selection and application of Texaco Aviation Fuels and Lubricants, will be glad to demonstrate that savings can be made with Texaco Perfected Lubrication.

For prompt engineering service and deliveries, phone the nearest of our 2279 warehouses in the U. S., or write:

The Texas Company, *Aviation Division,* 135 East 42nd Street, New York, N. Y.

TEXACO

NEW

TEXACO A

FOR IMMEDIATE ACTION!

Alva Base,
Miami Beach, Fla.
August 31, 1939

Mr. Aubrey Keif
Manager, Aviation Division,
The Texas Company
135 East 42nd Street
New York, N.Y.

Dear Mr. Keif:

As pilot for Mr. W. K. Vanderbilt, charged with keeping his Sikorsky S-43 ready for a half-hour local flight or a quick trip from Miami to New York, any day in the year, I feel that it has been possible to be constantly "on call" chiefly because of a crew of expert mechanics headed by Flight Engineer Henry C. Gerstung, and our use of Texaco aviation gasoline and oil.

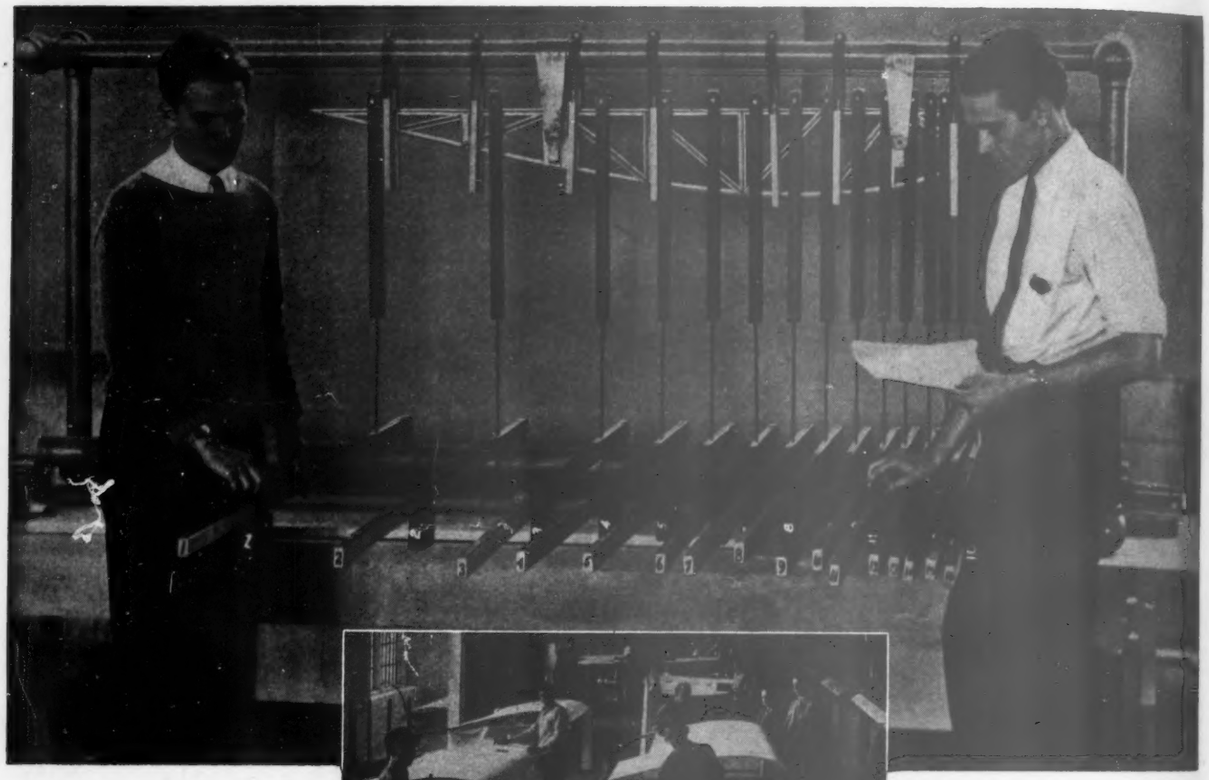
Very sincerely yours,

Rodney H. Jackson

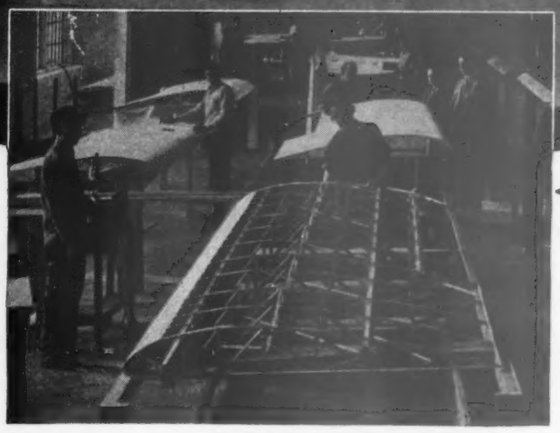
Airplane Oil

Texaco Dealers invite you to tune in The Texaco Star Theatre—a full hour of all-star entertainment — Every Wednesday Night—Columbia Network—9:00 E.S.T., 8:00 C.S.T., 7:00 M.S.T., 6:00 P.S.T.

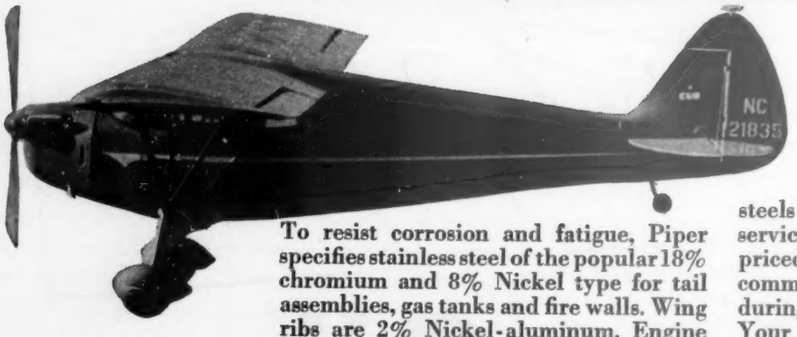
"Inside facts" reveal how Piper Cubs **LICK** *stress fatigue and* **CORROSION** *with* **NICKEL** *alloys*



↑ Photo shows 820 lbs. stress test on 7½ oz. Nickel alloy wing rib! Piper Cub wings withstand 6G power dives and outside loops. Wing ribs are Nicral, an aluminum alloy strengthened and toughened with 2% Nickel.



←Nickel alloy structural parts permit 4 times faster production than with wood, chiefly because Nicral 2% Nickel-aluminum alloy can be accurately fabricated and machine riveted. Here ribs and spars are being assembled in master jigs at the Piper Aircraft Corp. plant, Lockhaven, Pa. Practically every ship built, from tiny trainer to huge over-ocean transport, depends upon Nickel alloyed metals for maximum properties with minimum bulk and weight.



To resist corrosion and fatigue, Piper specifies stainless steel of the popular 18% chromium and 8% Nickel type for tail assemblies, gas tanks and fire walls. Wing ribs are 2% Nickel-aluminum. Engine parts and landing gear bolts are Nickel steels to insure more years of trouble-free service. High quality standards in a low priced plane, explain why *1 out of every 3* commercial planes built in this country during the past 4 years were Piper Cubs! Your consultation regarding aircraft applications of Nickel alloys is invited.

THE INTERNATIONAL NICKEL COMPANY, INC., 67 WALL ST., NEW YORK, N. Y.

AVIATION
Established 1918
THE OLDEST AMERICAN AERONAUTICAL MAGAZINE

NOVEMBER 1939
REGULAR EDITION

Contents for Vol. 38, No. 11

Flashes 13
Picked up Along Editorial Airways

Side Slips *By Robert R. Osborn* 17

4,000,000 New Customers *By Edwin J. Ahrens* 18
World's Fair Exhibit Opens New Market

Air Terminal de Luxe 20
New York's New Municipal Airport

By Land or By Sea 22
New York's Municipal Accommodates all Types of Planes

North Beach Nerve Center 24
Radio Equipment at the New Airport

40 Centimeter Instrument Landing *By Don Fink* 26
The C.A.A.-M.I.T. System

Financing Air Transports *By Selig Altschul* 28
How the Airlines Buy their Flying Equipment

Tethering the Airplane, Part II *By Walter C. Clayton* 30
Methods of "Making Fast"

S.A.E. Discusses Production *By C. F. McReynolds* 32
Papers and Discussion from the Annual West Coast Meeting

Planning for Production *By P. N. Jansen* 34
A Production Expert Expresses his Views

Magnesium Sheet for Aircraft *By B. L. Grant* 36
How the Airplane Designer May Save Weight

Flying Equipment 38

The Curtiss-Wright 20 Emerges... 38
Lockheed Lodestar 42
Taylorcraft Trainer 43
Bristol Sleeve Valve Engine 42
Rearwin 43

Buyers Log Book 48
A Review of New Equipment for the Industry

The Aviation News 51

National Aviation 52
Washington Windsock 53
National Defense 54
Aviation Abroad 57
As Others Fly It 58
Aviation People 60
Aviation Manufacturing 62
Finance 64
Profit and Loss 67
Transport Aviation 68

Operators Corner 71
Tagging the Bases with Les Neville

★

Louis F. Stoll
Vice-President

S. Paul Johnston
Editor

•

Leslie E. Neville
Managing Editor

Donald G. Fink
Radio Editor

Charles F. McReynolds
Pacific Coast

Paul Wooton
Chief of Washington Bureau

★

McGRAW-HILL PUBLISHING COMPANY, INC.
James H. McGraw, Founder and Honorary Chairman

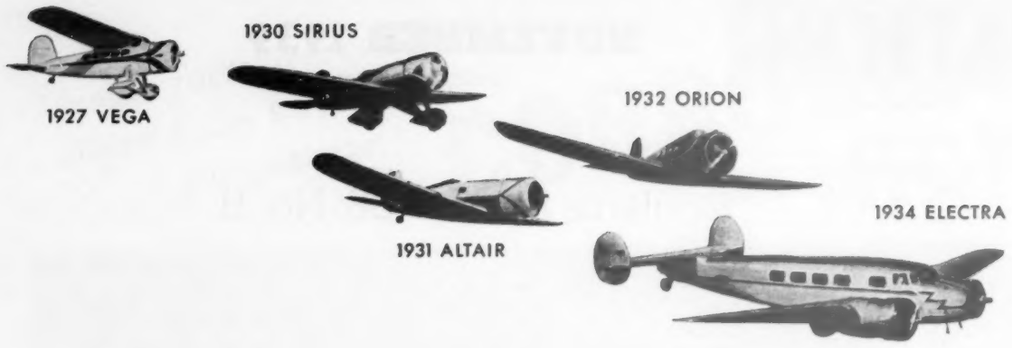
Publication Offices: 99-129 North Broadway, Albany, N. Y.
Editorial and Executive Offices: 330 West 42nd Street, New York, N. Y.

Chicago, 520 North Michigan Ave. San Francisco, 68 Post Street Los Angeles, 9121 Dalton Ave.
Aldwych, London, W. C. 2
Washington; Philadelphia; Cleveland; Detroit; St. Louis; Boston; Atlanta, Ga.

JAMES H. McGRAW, JR. President
HOWARD EHRLICH Executive Vice-President
MASON BRITTON Vice-Chairman
B. R. PUTNAM Treasurer
D. C. McGRAW Secretary
J. E. BLACKBURN, JR. Director of Circulation

Published monthly, price 35c a copy. Subscription rates—United States, Canada and Latin America republics, $3.00 a year. All other countries $5.00 a year or 30 shillings. Entered as second-class matter September 3, 1936, at the Post Office, Albany, N. Y., under the act of March 3, 1873. Printed in U. S. A. Cable address: "McGrawhill New York." Member of A.B.C. Copyright 1939 by McGraw-Hill Publishing Company, Inc., 330 West 42nd Street, New York, N. Y. The following publications are combined with AVIATION: AERONAUTICAL ENGINEERING, AIRCRAFT JOURNAL and THE AVIATION NEWS. All rights to above names are reserved by the McGraw-Hill Publishing Company.

A McGRAW-HILL PUBLICATION



...and now the LODESTAR

(LOCKHEED 18)

LOCKHEED

A GREAT NEW LOCKHEED

Ready for immediate airline delivery... Lockheed's newest transport – the Lodestar... a 17-place, two-engine airplane... at new low prices.

The Lodestar is the latest product of Lockheed's long experience in engineering and construction... an addition to the famous line of Lockheeds that have made aviation history and now serve 29 of the world's airlines.

LOCKHEED

LOCKHEED AIRCRAFT CORPORATION, Burbank, California • Representatives throughout the World

LOOK TO LOCKHEED FOR LEADERSHIP

Picked Up Along Editorial Airways

» NO DECISION yet marks the state of war in Europe as far as the air is concerned.. We write this with reservations, however, knowing full well that the ink may scarcely be dry before the lid may have been blown off and some of the questions that have here-to-fore been debatable may have been answered. At the moment, a stalemate seems to exist along the western front as far as the land forces are concerned. At sea, although Great Britain has lost two capital ships by submarine attack, the problem of airplane versus battleship is still unanswered. Scattered raids have been made against northern Navy bases, but these are obviously feelers and have had no serious destructive intent. This is indicated by the type of equipment involved. News pictures have shown that the types shot down by the British so far have been almost exclusively patrol flying boats of the DO-18 class. What will happen when real bombing raids begin with Heinkel 111s or other high performance bombers is yet anybody's guess.

» MAJOR ACCOMPLISHMENT so far has been to keep Great Britain in a continual state of the jitters. It may be a definite part of German strategy to wear down the nerves of the population by continuous air raid alarms. Or possibly they may be attempting to build up a sense of false security on the part of the British which may (they hope) result in relaxing defense measures so that when a major attack is made there may be a certain element of surprise in it. But whether or not any final attack is made, the German air threat has certainly succeeded in disrupting the whole economic life of Great Britain. The evacuation of the children has caused a complete reorganization of the distribution system. Business houses and banks have shut up shop and have moved their records and employees to the country. Petrol is short for civilian motor cars, and generally speaking, the average Britisher is putting up with discomforts and inconveniences that go very much against the grain.

HIGHEST AVIATION HONORS to Dr. Joseph S. Ames who has just retired as chairman of the National Advisory Committee for Aeronautics. He was the last of the original members of the Committee appointed by President Wilson in 1915, and his services over 24 years without compensation have contributed immeasurably to the advance of aviation in this country and all over the world. Second only to his brilliant scientific record has been his passion for accomplishment without publicity. We can only second what President Roosevelt said in accepting his resignation: "The remarkable progress for many years, and the improvement in performance, efficiency, and safety of American aircraft, both military and commercial, has been due largely to your own inspiring leadership in the development of new research facilities and the orderly prosecution of comprehensive research programs."

» GERMAN DELAY in uncorking destructive air raiding against Great Britain comes probably from two causes. First, it would have been foolish for Germany to stage major attacks against the British Isles as long as any hope remained for a settlement without further war after the Polish liquidation. At this time, however, it seems unlikely that Great Britain and France will accept a "dictated peace" and it may be that the final refusal will be the signal for the raids to begin against the British fleet, the British seaports, and British industry. The second deterrent, however, may be our present position with regard to our Neutrality Act. As it stands, there is little doubt but that the Neutrality Act is very favorable to Germany. In its embargo provisions it is equivalent to providing Germany with a powerful Atlantic fleet to prevent shipment of essential arms and materials to the Allies. The one thing that is holding up revision of the Neutrality Act at the moment is public opinion in America as reflected by the House of Representatives. The one thing that would shake U.S. public opinion out of the position it now takes would be destructive raiding in England with the attendant inevitable casualties among the civilian population. Such action might have even greater effect. It might possibly tip the scales away from the keep-out-of-war-at-any-cost sentiment that is in evidence all over America today.

» A PRESSING PROBLEM for light plane manufacturers these days is the shortage of aircraft spruce for wing spars. It is reported that the Japanese are taking practically all of the first grade spruce produced in this country. They have their inspectors stationed in the great western lumber centers, selecting practically the cream of our spruce crop for their own use.

with

AMERICA'S LEADING
AERONAUTICAL EXPORTERS

THE INTERCONTINENT CORPORATION

CABLE ADDRESS
INTERAERO
NEW YORK

30 ROCKEFELLER PLAZA
NEW YORK CITY
U. S. A.

They are paying all sorts of prices for it, generally about twice as much as American aircraft builders can afford to pay. The spruce shortage has created a serious bottleneck in our light plane production program and may shortly have a retarding effect on the C.A.A. pilot training program. Individual protests to Washington have so far been in vain. It seems to us that here is a point where joint action by the Aeronautical Chamber of Commerce and the State Department is indicated. The least we could do is to put an embargo on aircraft spruce until the available supply exceeds the demands of our own manufacturers. American spruce for American planes —FIRST !

» WITH FITTING CEREMONY Mayor LaGuardia dedicated the $40,000,000 North Beach Airport on October 15th. We have seen a lot of airports in our time, but except for the truly terrific project laid out by the Germans at Templehof, know of few other air terminals that are so closely geared to air transport demands of the future than North Beach. Elsewhere in this issue we are presenting a picture story of what has already been accomplished. The new port will undoubtedly contribute to the general advancement of air travel here in the east.

» KIBITZERS around steamshovels and excavations are commonplace in big cities. New Yorkers will remember the famous Sidewalk Superintendents Club organized during construction of various Rockefeller Center units. The air lines, in building the new consolidated terminal for New York, have taken a leaf from the Rockefeller book and have issued membership cards in the "Knot-hole Club" which authorizes the holder to kibitz "the construction of the World's Largest and Finest Air-lines Terminal, located at Park Avenue and 42nd Street, New York."

» TRAFFIC FIGURES are showing spectacular improvement. Preliminary reports indicate that the air lines of the country not only ended the last fiscal year in the black, but netted a substantial profit. As shown by AVIATION'S monthly transport indicator, the monthly averages for this year are generally 50 per cent or better ahead of the corresponding months of 1938. And more important from the revenue point of view, average seat occupancy is now running in the 65 per cent range, a hopeful sign for transport operators everywhere.

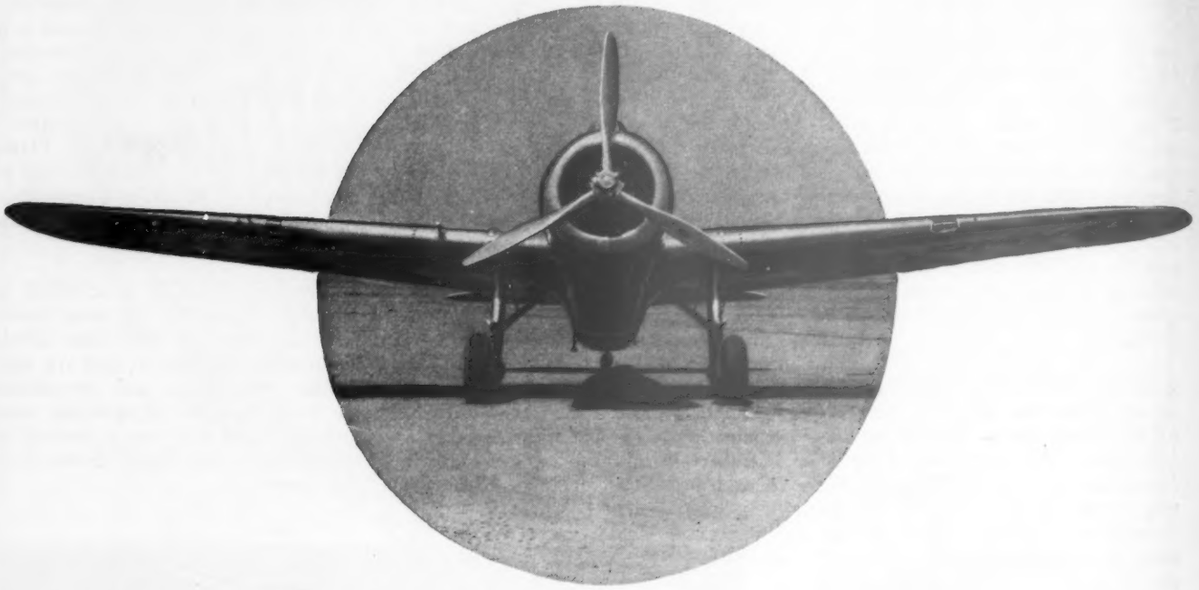
» ALL SIGNS POINT to the fact that transport aviation in America has at last turned the long awaited corner. Public acceptance of the airplane as a normal vehicle of transportation is very apparently taking hold at long last. Increased frequency of schedules, an outstanding safety record for the year, and last but not least, the beginning of a joint publicity and advertising campaign, are important contributing factors. The start of the advertising campaign is particularly impressive, with some excellent color spreads featuring prominent users of air transportation appearing in recent issues of national magazines. This is definitely a step in the right direction and will undoubtedly pay well deserved dividends.

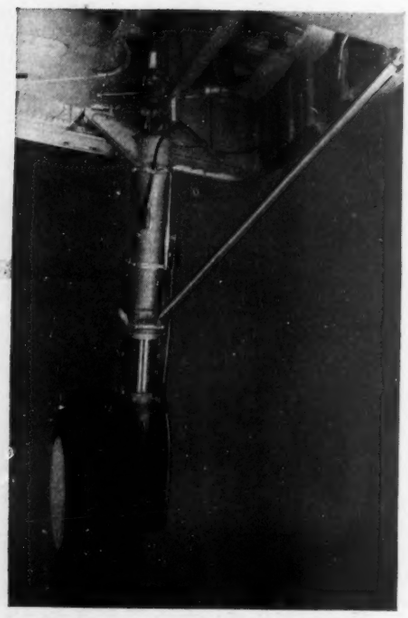
» EDITORS SHOULD CHECK claims made by publicity seekers to membership in the original Lafayette Escadrille. The original Escadrille consisted of one squadron of 15 pilots and their replacements, and totaled only 38 men, of whom 19 are now dead. In order to protect their interests, the surviving members of the Escadrille have incorporated themselves, and it is very easy to check claims of membership in the original group by communicating with Carl Dolan, corporation president, c/o Intercontinent Corporation at 30 Rockefeller Plaza, New York, N. Y. The letterhead of the Lafayette Escadrille Corporation lists the names of all members living and dead.

» AN ORCHID IN PASSING to Howard Mingos for his usual excellent job with the 1939 Year Book. What with conditions as they are, with military restrictions and everything, we think that Mr. Mingos has done unusually well this time in setting up the picture of the United States aviation industry.

"I see McGuire's finally putting the heat on Finnegan. He got the idea from the British propaganda raids".

Reconnaissance





In this close-up of Bendix Landing Gear Equipment as embodied in the design of North American's N. A. O-47, the structural strength, simplicity and accessibility of these units are obvious. Fully retractable. Hydraulic and pneumatic shock absorption are effectively combined. Bendix Wheel, brake and strut form an assembly of minimum weight consistent with strength demands.

also calls for maximum ground-maneuverability

It would seem reasonable to assume that swift, smooth, sure take-off and landing have fully as important a part in resultful reconnaissance as do air speed and handling ease.

In the design of the effective and justly popular N.A.O-47 observation airplane illustrated, its builders, North American Aviation, Inc., have embodied complete Bendix landing gear equipment—wheels, brakes, pneudraulic shock struts and tail-knuckle assembly.

The result is an exceptionally high degree of ground-maneuverability. Major landing impacts are absorbed, lesser shocks of taxi-ing and take-off runs are cushioned, while steering and stopping are facilitated by brakes that are nicely responsive.

Aircraft engineering staffs are urged to make fullest use of the experience and facilities for assistance available at Bendix.

BENDIX PRODUCTS DIVISION
of Bendix Aviation Corporation, South Bend, Indiana

Bendix

LANDING-GEAR EQUIPMENT

AIRPLANE WHEELS, BRAKES, PNEUDRAULIC SHOCK STRUTS, TAIL KNUCKLE ASSEMBLIES

Side Slips

By
ROBERT OSBORN

» THE PAPERS REPORT that the designer of the late Poland's newest pursuit ship had been interned in Rumania with his airplane, but in the process of making a "test flight" had flown the ship across still another border to complete his escape. We hope he does not lay claim to having originated this idea, as we know at least one designer in this country who has had a similar arrangement with his test pilot for a long time. As soon as the test pilot is sure that any new design is a hopeless "cluck," he will impart this in-

formation to the designer privately. They will then make another test flight, with a full load of gas, headed for a farm in South Dakota.

» The U. S. Coast Guard is reported to have the suspicion that former rum-runners, active during Prohibition days, are now engaged in refueling and supplying German submarines operating off the Atlantic coast. Someone ought to warn the Germans that the "Bathtub" fuel oil is likely to corrode their tanks through, and that they should examine the lubricating-oil cans carefully to make sure the oil hasn't been "cut."

» WE WERE CERTAINLY RIGHT, in our decision of about a year ago, to abandon the idea of going to a South Sea Island as a safe place in which to spend the duration of the war. A friend who has just returned from an extended survey flight in the Pacific reports landing at a small French island, about a thousand miles from all other inhabited islands, a few days after war had been declared. He found that all street lamps had been changed to the anti-air-raid pale blue color, the one city had a nightly black-out, and the lone German inhabitant had been placed in a concentration camp for "protection."

» Wirephotos published in the daily press show survivors of torpedoed freighters being rescued by flying boats landing beside the sinking vessel. Considering the number of would-be ocean flyers who have been rescued by freighters over many years, we are glad that aviation is now in a position to repay a debt of long standing. Of course the motto of the rescuing aircraft corps should be "S. S. Lafayette, we are here!"

» A SCIENTIST CLAIMS in the daily press that accurate bombing by means of aerial rockets with a hundred mile range is already possible with the present knowledge in that particular field of research, and that a thousand-mile accurate range will soon be feasible.

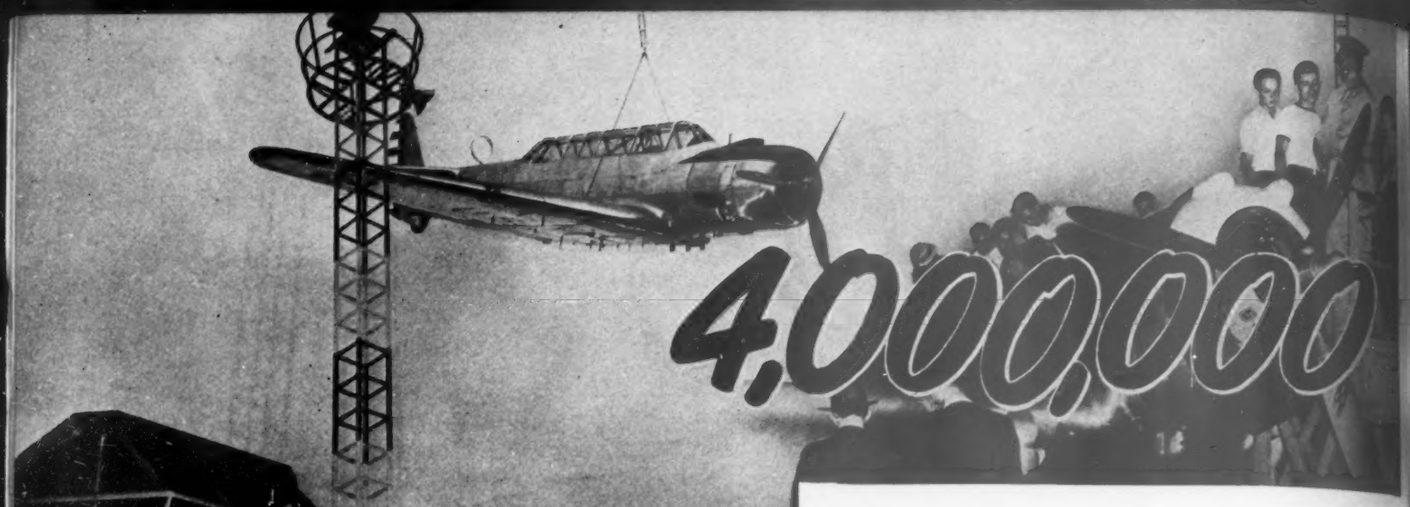
Who remembers the cartoon, published during the first World War, of the two soldiers discussing the German long range gun which bombarded Paris, one of them commenting, "Shucks, Buddy, in the next war all they're going to need is your address"?

» WE ARE NOTICING an increasing number of items in the papers about light airplanes landing in auto parking spaces for overnight storage, landing on highways in order to gas up at roadside stations, and so on. This sort of thing is all very convenient for the pilots and is a fine testimonial to the adaptability of the modern "flivver" plane, but we must warn the pilots

that if these activities keep up much longer they are going to find themselves under the eagle eyes of the various state police departments as well as under the all-seeing eye of the C.A.A.

» "WHILE ALL MALE PILOTS WERE GROUNDED for the day at Hartung Airport, ten Michigan women pilots took over the air Sunday afternoon and proceeded to stage their annual air show before a crowd of 8,000 persons."—*Detroit Free Press.*

We've never seen ten women pilots in the air at one time, except in the special races for them at Cleveland, but we have run afoul of ten women automobile drivers on a single Sunday afternoon. With our car experiences in mind we can't help but wonder if "all male pilots were grounded" or whether they just up and grounded themselves.



World's Fair

Millions of people who have seen airplanes only through airport fences have seen them at closer range at the Aviation Exhibit. They have come away with greatly changed ideas as to what this business is all about.

By Edwin J. Ahrens

Technical Supervisor, N. Y. Worlds Fair Aviation Exhibit

FOR the first time in the history of the aviation industry many of its leading airline, aircraft and accessory companies, together with various special services and flying schools, have joined forces in a co-operative and large scale attempt to bring flying close to the general public. The fruit of this effort has taken shape in the U. S. Aviation Exhibit at the New York World's Fair of 1939.

Supported by Army and Navy participation, the exhibit has been tremendously popular with the public since the day of its opening. Designed for the promotion of aviation's three major flying branches, namely, passenger transportation, private flying and national defense, it naturally embraces wide-scope airminded interests. A total of more than 4,000,000 interested visitors tends to label it a gilt edge investment, and offers convinc-

Exhibit Opens New Market

ing evidence of a need for continued joint promotional activity of the sort.

Are all of these people seriously interested? A logical question. As anyone acquainted with large exhibition crowds will understand, many wander into the building quite by chance or because it happens to be along their line of march. Some come in and hurry through, too tired or disinterested to look either to the right or left. Regardless of first impulses, however, the great majority remains indefinitely to study and re-study the many fascinating and instructive displays, and large numbers tarry within the building for hours on end, often long outstaying the time originally intended.

Possibly the truest index of visitor interest in a display is the amount of effort and patience spent in its inspection. One large display is that of a full size and completely equipped model of a 36 passenger airliner which may be reached only by way of two sets of stairs and a long winding elevated platform. Despite crowds that bunch up on this platform, frequently requiring a ten to fifteen minute wait in line, over 1,500,000 visitors have been clocked studying this one display. A majority probably realize for the first time that flying has gone beyond the open cockpit stage. Compare this 1,500,000 clocked figure with the estimated total number of individuals supporting scheduled transport lines in 1938—a mere 250,000, and it assumes added significance.

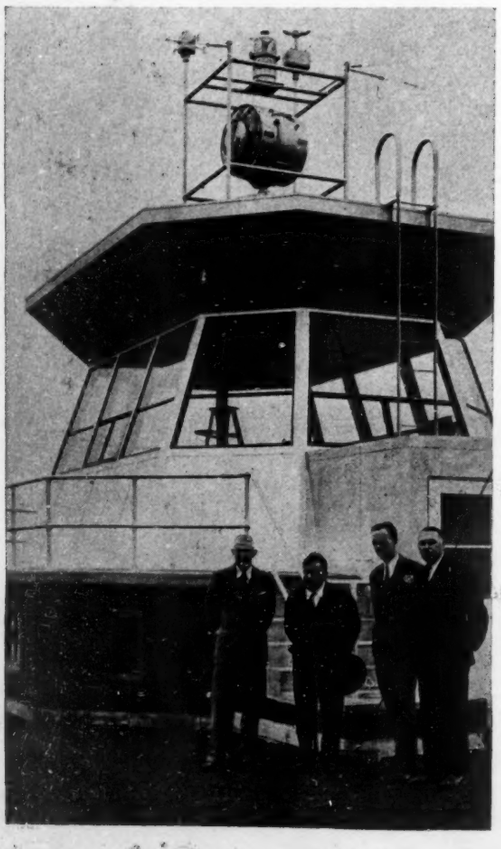
It is difficult to rate the public's curiosity with respect to various aspects of flying. Three types of questions seem to predominate. Safety angles lead all others, with cost and passenger comfort perhaps falling in second and third place. Speed and technical points also are well represented. Attendants invariably report that most of the questions they receive are intelligent and reflect keen interest. Once in a while the inevitable exception occurs, but that a definite need for public education exists is shown by the thousands of earnest questions hourly showered upon the exhibit personnel.

This need is further emphasized by the many odd misapprehensions brought to light. Astonishment is often expressed that airway trip insurance is now no more expensive than railway trip insurance. A surprising number exclaim that they didn't know insurance was available at any price. A common false impression is that an airplane is "held up" by its propellor and that it must plummet to earth once the engine falters. Relatively few people seem to have even the slightest understanding of radio signals and other flying aids. They are ignorant of their existence, let alone their principles. It is a common assumption that airplanes fly a more or less inflexible, straight line route through cloud and storm and the explanation and demonstration of simple indirect flight control manouvers is met with surprised interest.

(*Turn to page 46*)

AIR TERMINAL

No expense has been spared to fit New York's Municipal Airport to the Needs of the World's Greatest Metropolis.



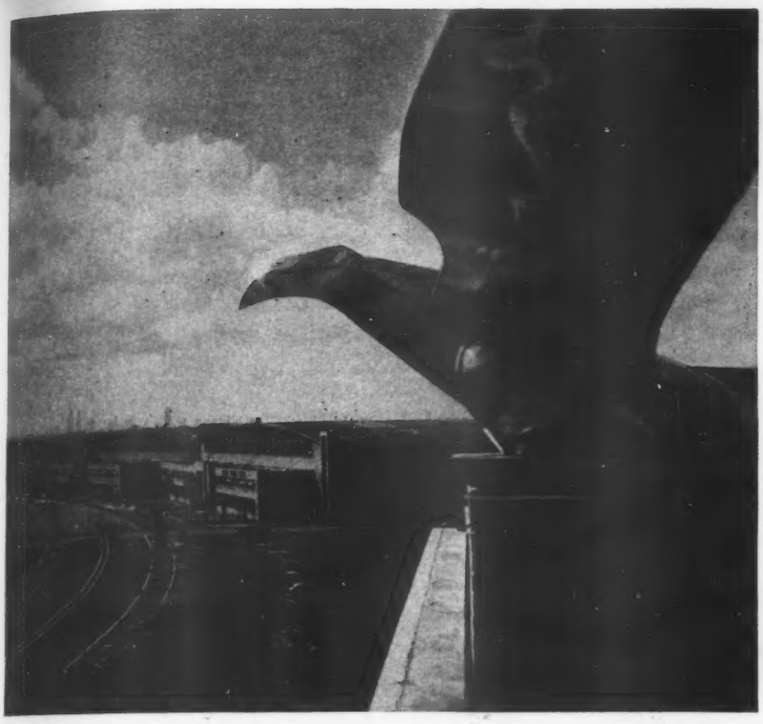
FORTY MILLION DOLLARS, seventeen million yards of dry refuse, the labor of thousands of W.P.A. workers, and the persistence of Mayor Fiorello LaGuardia, are the principal ingredients that were mixed to make New York's Municipal Airport one of the largest and best appointed in the world. No matter what you think of the city administration or of the W.P.A., a glance at the new air terminal will convince you that a real job has been done. The next question that arises in your mind is whether or not any of the 40 million will be seen again. Acting Director Elmer Haslett has an answer for this one. He will show you that the project is self-liquidating. Here's how.

Tear shedders: Mayor La Guardia has said that the tears shed by the constructors of the port would water the entire planted area. With the "Little Flower" here are W.P.A. Administrator Brehon Somerville (left); Acting Chief Engineer James S. Kenney (right); and Acting Director Elmer Haslett (extreme right).

First we must dispose of the W.P.A. contribution of 25 million. That is gone to provide unemployment relief to thousands. The remaining 15 million is the city's stake and that will amortize nicely at 5 per cent a year. So the airport must yield $750,000 a year in rentals and concession fees. And since all the space has been rented, all that remains is to collect the rent.

Lion's share of the annual take will come from the Hotel New Yorker which runs four restaurants of different sizes and types at several points around the airport. Thus the food-consuming public will be let in as contributors. Most substantial airline tenant is American Airlines which has leased three of the six landplane hangars and is moving in its maintenance base from Chicago. The three uncompleted landplane hangars will be occupied by United, T.W.A. and Canadian Colonial Airways.

Another source of revenue will be from passengers whose time is so valu-

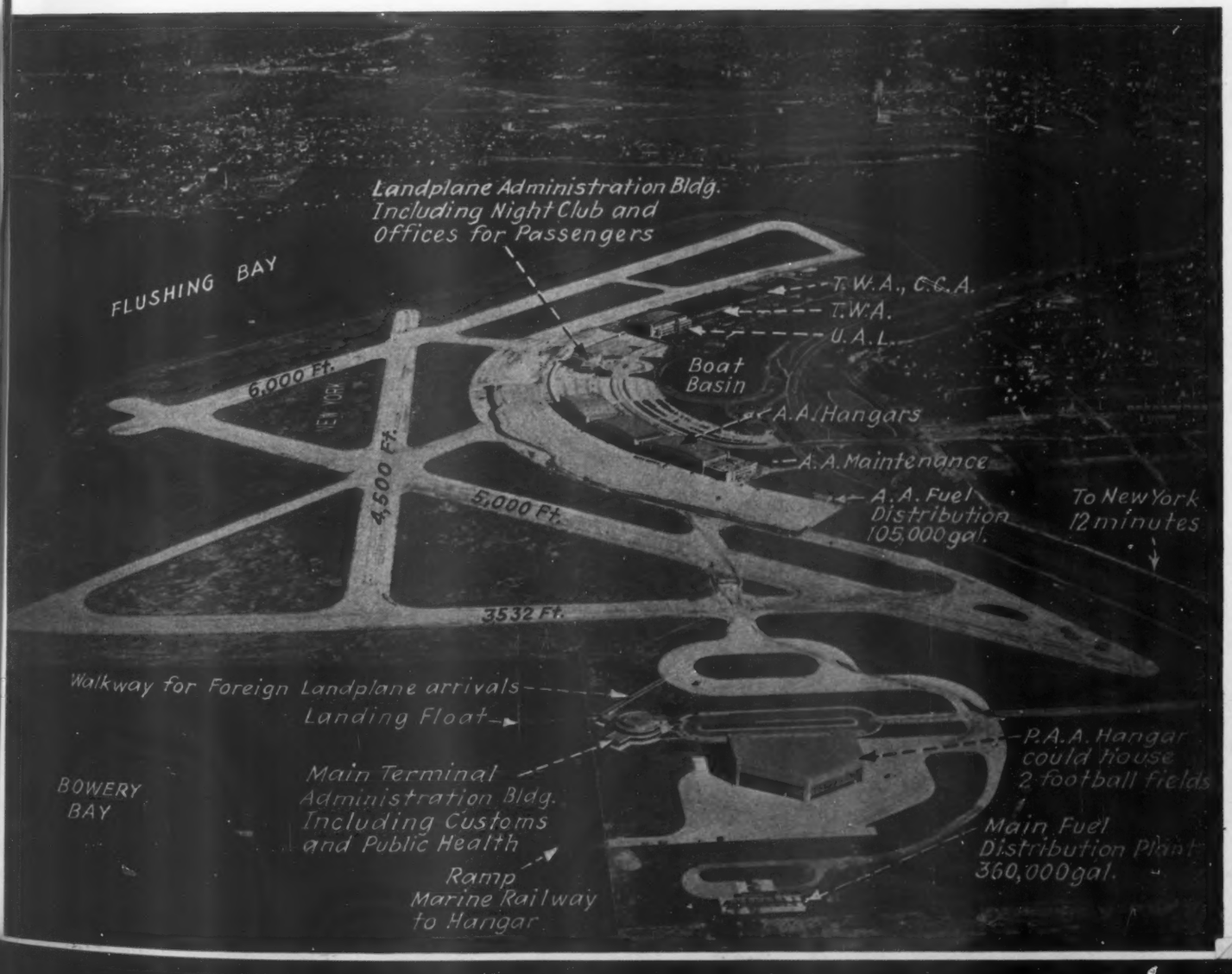


DE LUXE

able that it is economical for them to conduct business conferences at the airport while awaiting airplane connections. Four completely equipped offices have been set up and may be rented for a day or any portion thereof at rates up to $75 per day for the largest which is labeled "Mayor's Office." Other space in the administration building costs $2.00 per foot per year.

New York Municipal Airport has been built to Class 4 specifications of the C.A.A. Asphalt runways are 200 ft. wide and taxi strips 150 ft. in width, on a 12 in. solid rock footing. A mile-long concrete apron 400 ft. wide faces the administration building. A 6,000 ft. runway for instrument landings is provided on the Flushing Bay side of the port and additional fill would provide a footing for a parallel runway of equal length.

Runways and taxi strips are lighted every 200 ft. on both sides by Crouse-Hinds contact lights. Boundary lights are set at 250 ft. intervals and neon approach lights extend 3,000 ft. All obstructions within two miles are lighted.



BY **LAND**

American Airlines

Front Door: Passengers check their baggage and tickets and descend to the lower level where they proceed to the loading gates shown. Wives and sweethearts remain on the upper deck, safe from congestion and propellers, and wave good-bye. On their return they may pass by the bar.

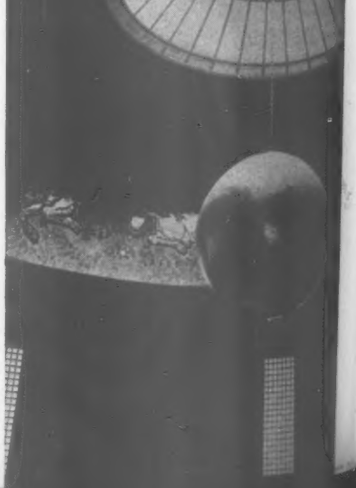
Back Door: Outgoing passengers and night club patrons approach the administration building from the Grand Central Parkway extension. The back door is 12 minutes from 125th Street, New York, and 22 minutes from Grand Central Station.

Central dome of the administration building.

Aviation

WPA

Landplane Hangars: Dimensions are 363 ft. by 165 ft. by 68 ft. Door opening is 42 ft. high. Three are completed and three more are under construction. Automatic Sprinkler System, Holoplane Lighting, and 25 ton Truscon doors are included in the equipment.

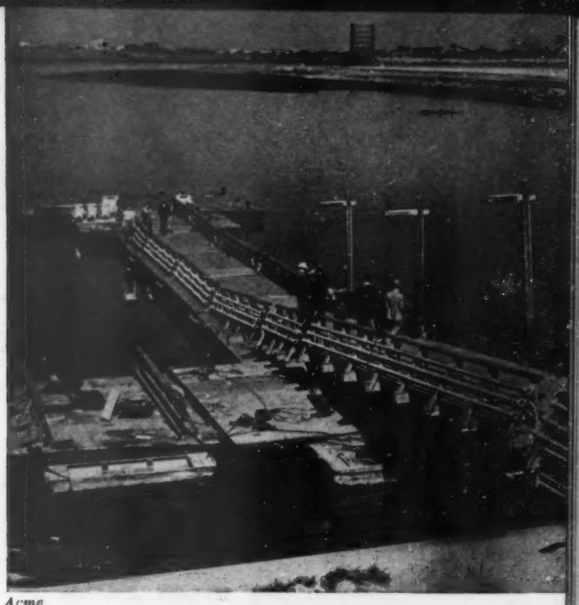


OR BY **SEA**

New York's new airport is really two terminals in one. In addition to the landplane facilities for the domestic airlines, there is a complete marine base including a large hangar and administration building for transoceanic operation.

LANDPLANE and seaplane bases are about a mile apart and include a total of 24 buildings. Ground traffic over the entire field is controlled by a system of traffic signals. Four hundred miles of electric wire and 200 miles of cable are used in the lighting system. The underground fibre cable was selected because of its acid resisting qualities and its ability to withstand the settling of the fill.

Although the new terminal is just another dock to Commissioner John McKenzie, under whose municipal jurisdiction it is placed, he has considered it so important that he and Chief Engineer Joseph Meehan moved their offices to the airport several months ago. W.P.A. work on the project was done under the forceful direction of Administrator Brehon Somervell.



Acme

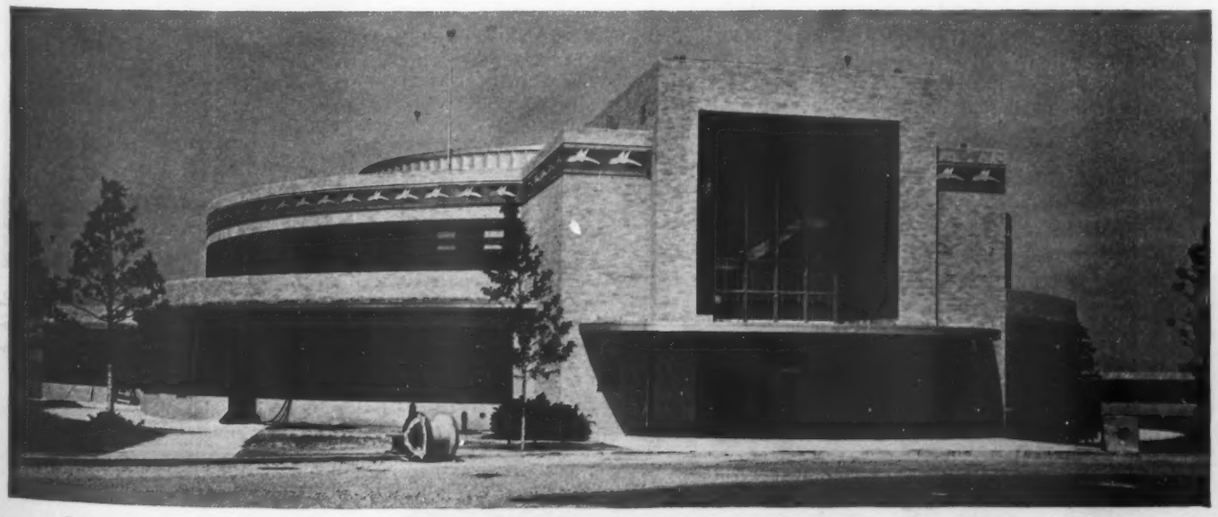
Arrivals by Sea: From this seaplane float, passengers are led through customs in the Marine Terminal Administration Building.

Airport Statistics *

Airport area	558 acres
Fill	17,300,000 cu. yd.
Buildings	931,500 sq. ft. floor
Buildings	36,215,564 cu. ft.
Hangar doors (25 tons each)	20
Concrete	102,100 cu. yd.
Concrete piles under buildings	9,012 piles—135 miles
Brick	13,000,000
Carloads of cement	1,000
Steel	20,000 tons
Reinforcing steel	3,500 tons
Duct lines	160 miles
Cable	200 miles
Wire	400 miles
Underground piping	25 miles
Fire pumps	12,000 gal. capacity
Runways and taxi strips	3⅞ lineal miles
Aprons	53 acres
Crushed rock	450,000 cu. yds.
Asphalt	3,000,000 gals.

* Figures for buildings cover only those constructed.

Built for Expansion: Already large enough for two football fields, the Marine Terminal Hangar may be made still larger. Now it is a 5-sided structure, with a rectangular section 350 ft. by 169 ft. The angular section walls are 204 ft. long and may be straightened out to increase floor area.



Port of Entry: The Marine Terminal Administration Building has all the facilities for international arrivals and departures.

NORTH BEACH
Nerve Center

Exceptionally complete and flexible control tower installation feature of new airport radio facilities

By Don Fink

THE radio facilities of the New York Municipal Airport at North Beach, even in their present incomplete form, show definitely that the best has been none too good for the Mayor and his cohorts. The receiver installation for the control tower, for example, has no less than 21 units, 15 remotely operated on Riker's Island, and six in the tower itself. Monitoring stations in the engineering and administrative offices permit listening in to any or all of these channels at the flip of a switch. The radio range, a SMRA-Z installation is at Maspeth, Long Island, is more or less conventional. The cone-of-silence Z marker beacon of this range station is the only ultra-high frequency equipment as yet installed, but there are plenty of plans for more.

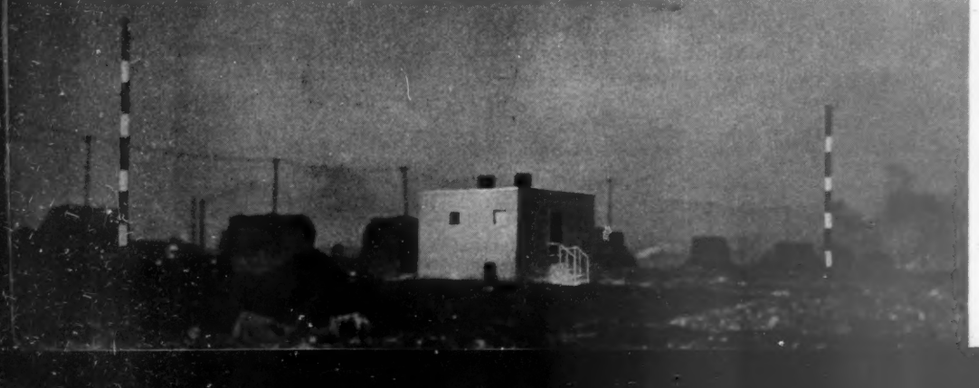
The control tower installation, except for minor details, is now complete and a very impressive job it is. The transmitting equipment consists of two transmitters made and installed by the Radio Receptor Company, who executed the contract for all the control tower radio equipment. The transmitters, 15-watt units operating on 362 kc, are duplicated throughout for regular and standby service. The main power source for the transmitters has been duplicated also.

The receiving equipment is as elaborate as that of any airport in the World, and considerably more flexible. In all there are 21 receivers. Six of these are in the control itself. They are National receivers of special design, somewhat resembling the HRO type, and are tunable throughout the entire range of aviation frequencies (except the ultrahighs). These receivers are intended principally for standby service, since the remaining 15 receivers located on Riker's Island handle the airline and itinerant frequencies. The local receivers serve to accept messages on any frequency outside the usual traffic channels, and hence must be accurately calibrated in kilocycles. The tuning mechanism is such that any frequency may be tuned in "on the nose" by reference to the calibration chart.

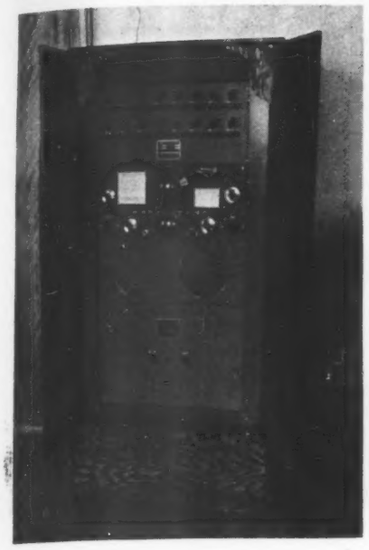
The remotely-operated receivers, 15 in number, are housed in a small shack on the edge of the dumping ground at Riker's Island. This location is substantially free from man-made sources of noise, and provides plenty of room for antenna installations.

The receivers themselves of Western Electric Type 23's, crystal controlled and fixed tuned. Thirteen of the fifteen receivers have already been assigned frequencies, as follows: For the American Airlines: 3232.5, 3257.5, 5612.5, 5632.5, and 5652.5 kc; for TWA: 3088, 4937.5; for United 3162.5, 5572.5; for Eastern 4422.5; for the U. S. Army 4495; for Pan American 2870; and the itinerant frequency 3105 kc. The receivers may be tuned to any single frequency between 2 and 20 Mc, and when crystal controlled have a frequency stability of plus or minus 0.01 per cent from zero to 60 degrees Centigrade. The sensitivity is one microvolt, 30 per cent modulated, for 50 milliwatts output. The image response, one of the most remarkable aspects of the design is 100 db down (voltage ratio of 100,000-to-1 between the desired signal and the image frequency). This rejection is accomplished in a single r-f stage by means of link circuits.

The noise suppression circuit is of unusual design. It was developed by the Bell Labs, and is known as the Codan Circuit ("Carrier Operated Device, Anti-Noise"). It operates as follows: From the i-f amplifier, the 455 kc carrier is derived, and mixed with the output of a 300 kc crystal, producing a 755 kc second i-f. This is then mixed with the original 455 kc to obtain a 300 kc. signal. In the absence of a carrier, this latter signal disappears. However noise inputs and off-tuned signals must not operate the receiver, hence the 300 kc signal is passed through two filters, one band pass in form, the other band rejection, both having narrow (1200 cycle) pass or rejection regions. The two filters are complementary. If a carrier, tuned to the frequency for which the receiver is set, arrives, it affects each filter equally. If noise, or an off-tuned carrier arrives, the filters are affected differently. The output of the filters is then used to operate a polarised relay whose contacts are in the grid circuit of the first a-f tube. In the

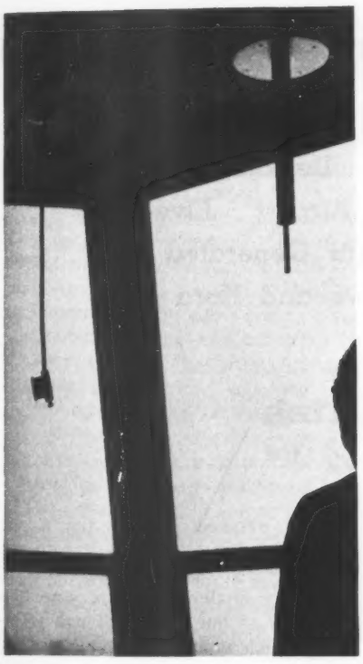


The remote receivers at Riker's Island. Above, nine of the fifteen crystal controlled receivers; left, the shack and antenna poles.



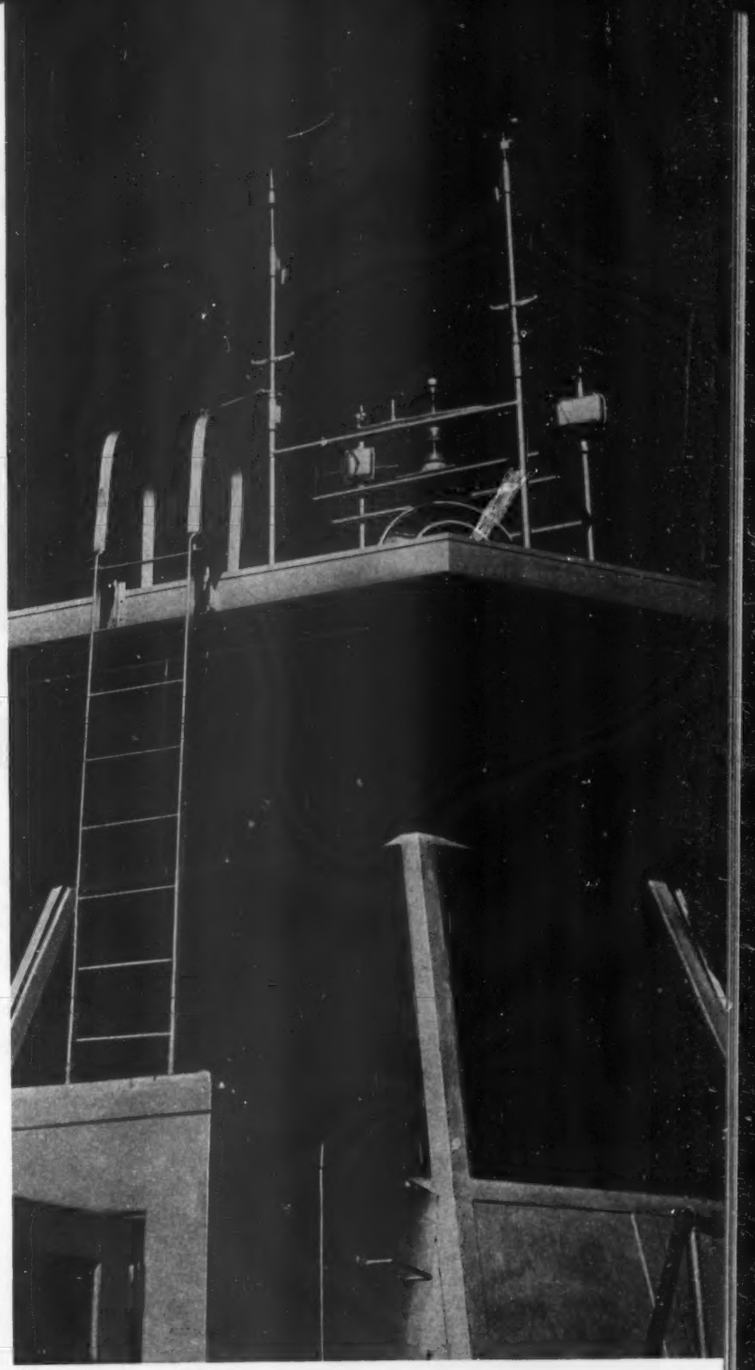
Left: The Monitor equipment in the Director's and Assistant Director's offices can listen in on any receiver, or all of them, at the flip of a switch.

Right: The transmitting antenna system on the control tower. Control tower personnel represents many years of experience at busy air terminals. The four senior operators are: Gordon Hamilton (Newark); Henry Brady (Cleveland); Paul Norrington (Pittsburgh); and William Darby.

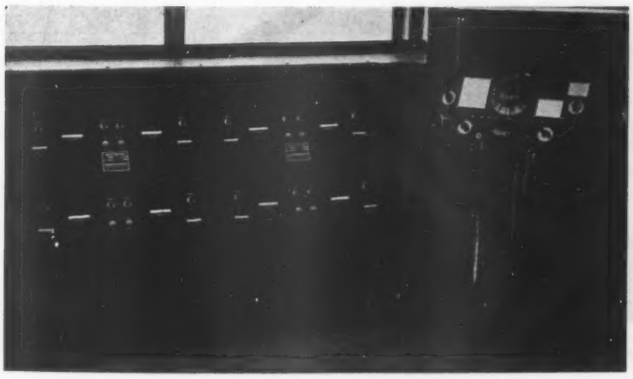


Left: The microphone, suspended from a spring-wind reel, is out of the way until needed.

Below: The receivers and speakers are grouped around the operator on slanting panels which divert the sound to the center of the room.



Photos by AVIATION



presence of noise or off-carrier signals the relay acts to disconnect the audio. Hence the receivers remain completely inoperative until the carrier for which they are set is received. The Codan circuit may be disconnected by the control tower operator, if necessary, by flipping a switch.

The 21 loudspeakers of the installation are grouped around the tower room on sloping panels so that each receiver has an equal chance of being heard in the center of the room. Each panel has a signal light indicating the operation of its associated receiver.

BY **LAND**

American Airlines

Front Door: Passengers check their baggage and tickets and descend to the lower level where they proceed to the leading gates shown. Wives and sweethearts remain on the upper deck, safe from congestion and propellers, and wave good-bye. On their return they may pass by the bar.

Back Door: Outgoing passengers and night club patrons approach the administration building from the Grand Central Parkway extension. The back door is 12 minutes from 125th Street, New York, and 22 minutes from Grand Central Station.

Central dome of the administration building.

Aviation

WPA

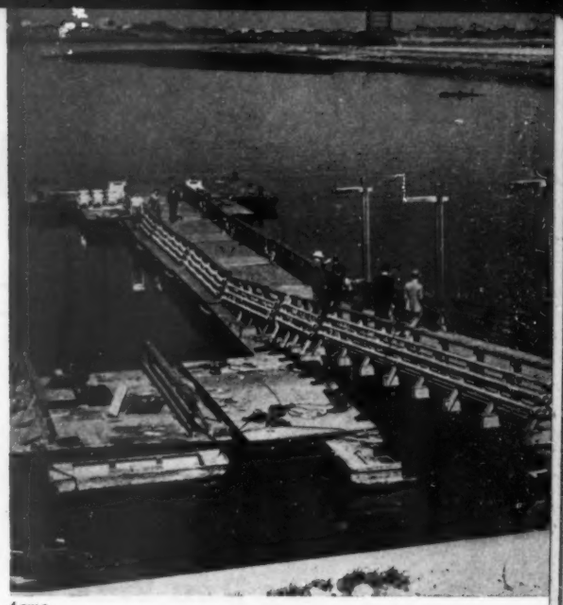
Landplane Hangars: Dimensions are 363 ft. by 165 ft. by 68 ft. Door opening is 42 ft.

OR BY **SEA**

New York's new airport is really two terminals in one. In addition to the landplane facilities for the domestic airlines, there is a complete marine base including a large hangar and administration building for transoceanic operation.

LANDPLANE and seaplane bases are about a mile apart and include a total of 24 buildings. Ground traffic over the entire field is controlled by a system of traffic signals. Four hundred miles of electric wire and 200 miles of cable are used in the lighting system. The underground fibre cable was selected because of its acid resisting qualities and its ability to withstand the settling of the fill.

Although the new terminal is just another dock to Commissioner John McKenzie, under whose municipal jurisdiction it is placed, he has considered it so important that he and Chief Engineer Joseph Meehan moved their offices to the airport several months ago. W.P.A. work on the project was done under the forceful direction of Administrator Brehon Somervell.



Acme

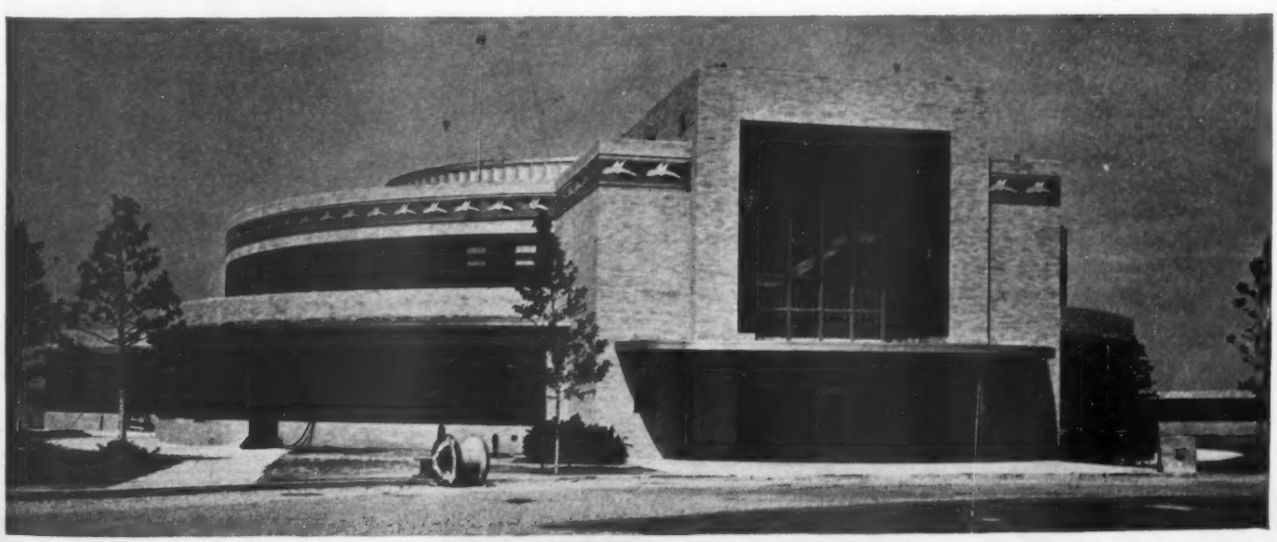
Arrivals by Sea: From this seaplane float, passengers are led through customs in the Marine Terminal Administration Building.

Airport Statistics *

Airport area	558 acres
Fill	17,300,000 cu. yd.
Buildings	931,500 sq. ft. floor
Buildings	36,215,564 cu. ft.
Hangar doors (25 tons each)	20
Concrete	102,100 cu. yd.
Concrete piles under buildings	9,012 piles—135 miles
Brick	13,000,000
Carloads of cement	1,000
Steel	20,000 tons
Reinforcing steel	3,500 tons
Duct lines	160 miles
Cable	200 miles
Wire	400 miles
Underground piping	25 miles
Fire pumps	12,000 gal. capacity
Runways and taxi strips	3⅜ lineal miles
Aprons	53 acres
Crushed rock	450,000 cu. yds.
Asphalt	3,000,000 gals.

* Figures for buildings cover only those constructed.

Built for Expansion: Already large enough for two football fields, the Marine Terminal Hangar may be made still larger. Now it is a 5-sided structure, with a rectangular section 350 ft. by 169 ft. The angular section walls are 204 ft. long and may be straightened out to increase floor area.



Port of Entry: The Marine Terminal Administration Building has all the facilities for international arrivals and departures.

NORTH BEACH Nerve Center

Exceptionally complete and flexible control tower installation feature of new airport radio facilities

By Don Fink

THE radio facilities of the New York Municipal Airport at North Beach, even in their present incomplete form, show definitely that the best has been none too good for the Mayor and his cohorts. The receiver installation for the control tower, for example, has no less than 21 units, 15 remotely operated on Riker's Island, and six in the tower itself. Monitoring stations in the engineering and administrative offices permit listening in to any or all of these channels at the flip of a switch. The radio range, a SMRA-Z installation is at Maspeth, Long Island, is more or less conventional. The cone-of-silence Z marker beacon of this range station is the only ultra-high frequency equipment as yet installed, but there are plenty of plans for more.

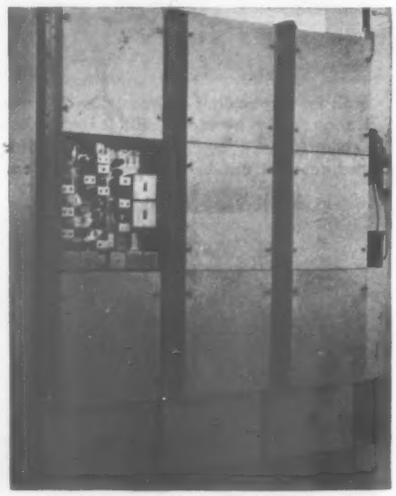
The control tower installation, except for minor details, is now complete and a very impressive job it is. The transmitting equipment consists of two transmitters made and installed by the Radio Receptor Company, who executed the contract for all the control tower radio equipment. The transmitters, 15-watt units operating on 362 kc, are duplicated throughout for regular and standby service. The main power source for the transmitters has been duplicated also.

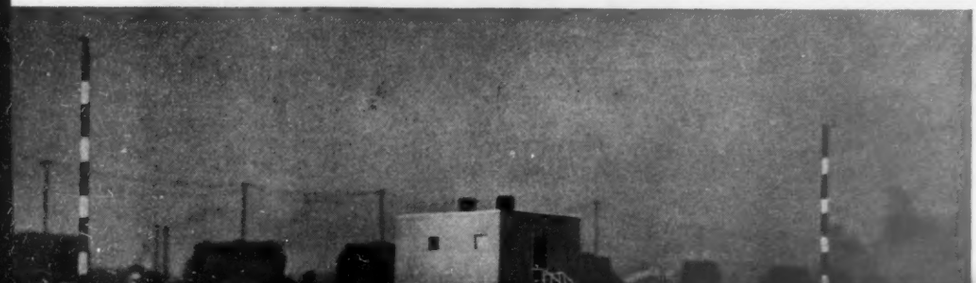
The receiving equipment is as elaborate as that of any airport in the World, and considerably more flexible. In all there are 21 receivers. Six of these are in the control itself. They are National receivers of special design, somewhat resembling the HRO type, and are tunable throughout the entire range of aviation frequencies (except the ultrahighs). These receivers are intended principally for standby service, since the remaining 15 receivers located on Riker's Island handle the airline and itinerant frequencies. The local receivers serve to accept messages on any frequency outside the usual traffic channels, and hence must be accurately calibrated in kilocycles. The tuning mechanism is such that any frequency may be tuned in "on the nose" by reference to the calibration chart.

The remotely-operated receivers, 15 in number, are housed in a small shack on the edge of the dumping ground at Riker's Island. This location is substantially free from man-made sources of noise, and provides plenty of room for antenna installations.

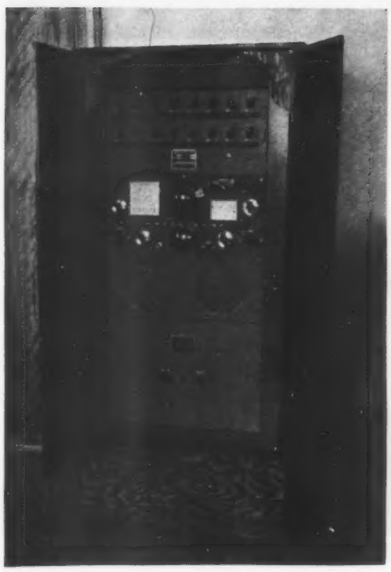
The receivers themselves of Western Electric Type 23's, crystal controlled and fixed tuned. Thirteen of the fifteen receivers have already been assigned frequencies, as follows: For the American Airlines: 3232.5, 3257.5, 5612.5, 5632.5, and 5652.5 kc; for TWA: 3088, 4937.5; for United 3162.5, 5572.5; for Eastern 4422.5; for the U. S. Army 4495; for Pan American 2870; and the itinerant frequency 3105 kc. The receivers may be tuned to any single frequency between 2 and 20 Mc, and when crystal controlled have a frequency stability of plus or minus 0.01 per cent from zero to 60 degrees Centigrade. The sensitivity is one microvolt, 30 per cent modulated, for 50 milliwatts output. The image response, one of the most remarkable aspects of the design is 100 db down (voltage ratio of 100,000-to-1 between the desired signal and the image frequency). This rejection is accomplished in a single r-f stage by means of link circuits.

The noise suppression circuit is of unusual design. It was developed by the Bell Labs, and is known as the Codan Circuit ("Carrier Operated Device, Anti-Noise"). It operates as follows: From the i-f amplifier, the 455 kc carrier is derived, and mixed with the output of a 300 kc crystal, producing a 755 kc second i-f. This is then mixed with the original 455 kc to obtain a 300 kc. signal. In the absence of a carrier, this latter signal disappears. However noise inputs and off-tuned signals must not operate the receiver, hence the 300 kc signal is passed through two filters, one band pass in form, the other band rejection, both having narrow (1200 cycle) pass or rejection regions. The two filters are complementary. If a carrier, tuned to the frequency for which the receiver is set, arrives, it affects each filter equally. If noise, or an off-tuned carrier arrives, the filters are affected differently. The output of the filters is then used to operate a polarised relay whose contacts are in the grid circuit of the first a-f tube. In the



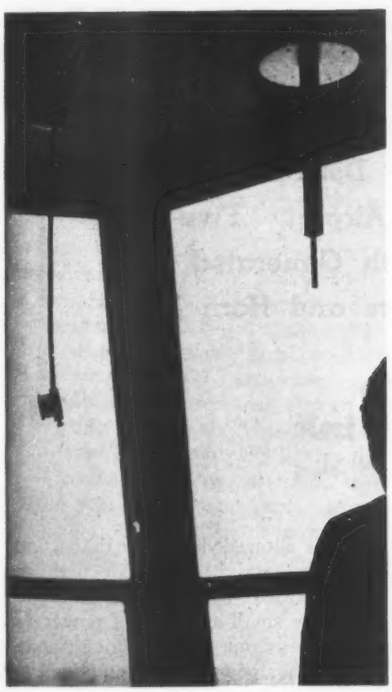


The remote receivers at Riker's Island. Above, nine of the fifteen crystal controlled receivers; left, the shack and antenna poles.



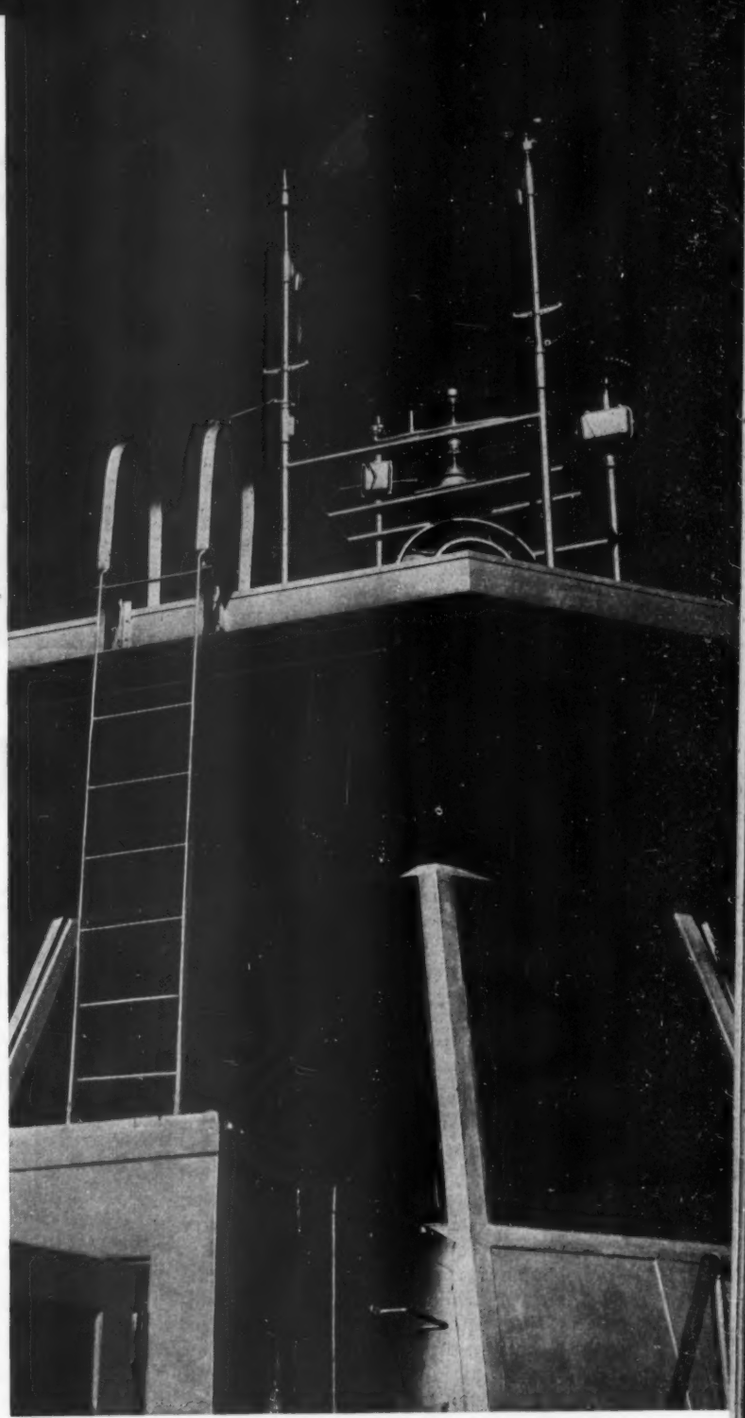
Left: The Monitor equipment in the Director's and Assistant Director's offices can listen in on any receiver, or all of them, at the flip of a switch.

Right: The transmitting antenna system on the control tower. Control tower personnel represents many years of experience at busy air terminals. The four senior operators are: Gordon Hamilton (Newark); Henry Brady (Cleveland); Paul Norrington (Pittsburgh); and William Darby.

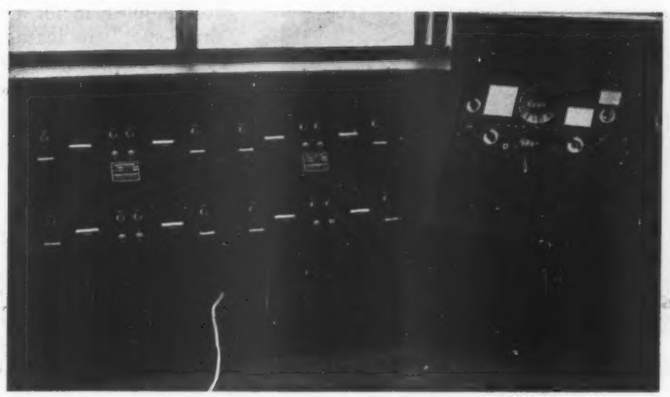


Left: The microphone, suspended from a spring-wind reel, is out of the way until needed.

Below: The receivers and speakers are grouped around the operator on slanting panels which divert the sound to the center of the room.

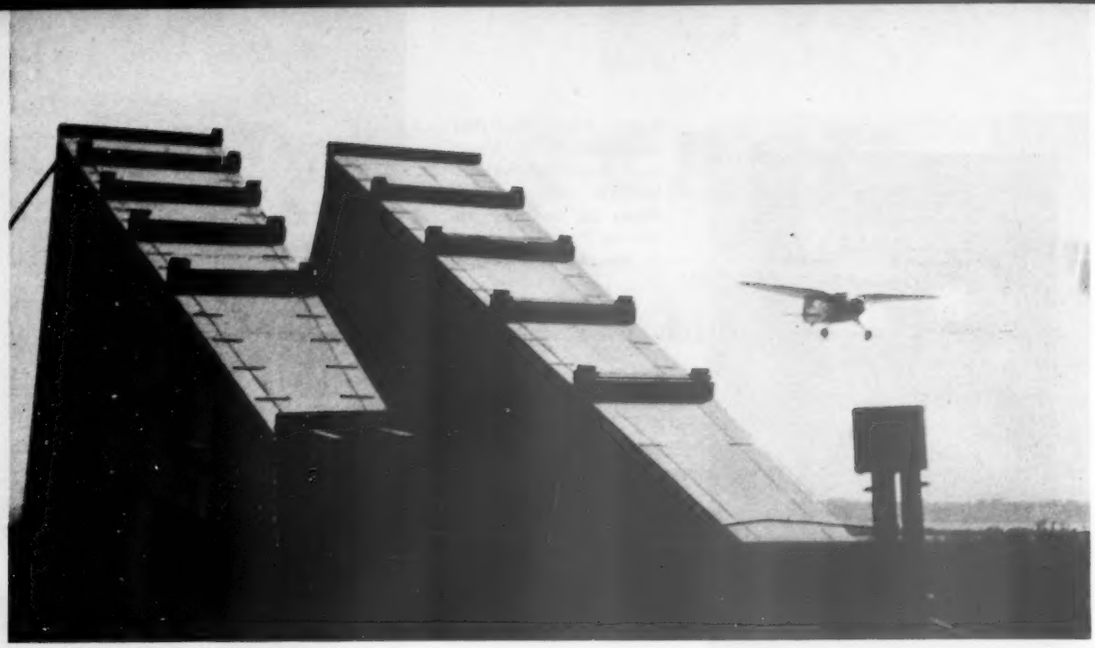


Photos by AVIATION



presence of noise or off-carrier signals the relay acts to disconnect the audio. Hence the receivers remain completely inoperative until the carrier for which they are set is received. The Codan circuit may be disconnected by the control tower operator, if necessary, by flipping a switch.

The 21 loudspeakers of the installation are grouped around the tower room on sloping panels so that each receiver has an equal chance of being heard in the center of the room. Each panel has a signal light indicating the operation of its associated receiver.



On the glide path during the test flights

INSTRUMENT LANDING

C.A.A.-M.I.T. System Demonstrated to C.A.A. at Boston Airport. Five-Mile Straight-Line Glide-Path Generated with Low-Power Transmitters and Horn Radiators.

By Don Fink

Radio Editor, Aviation

ON September 16th the C.A.A.-M.I.T. system of instrument landing, which has been reviewed in these pages as it developed from the idea suggested by Irving R. Metcalf to a working reality (see AVIATION, September 1938, page 28) was given its first official demonstration to engineers of the C.A.A. at the East Boston Airport. The occasion was called for the purpose of allowing the C.A.A. authorities to judge whether or not their contract with M.I.T. had been fulfilled. To that end the necessary ground equipment was installed, in temporary fashion, at one edge of the airport, while the receiving and indicating equipment was loaded into a C.A.A. Stinson. Messrs. Gazeley, Easton and Metcalf represented the C.A.A. while Professor E. L. Bowles, Dr. W. L. Barrow, Dr. W. M. Hall and their assistants F. D. Lewis and D. E. Kerr put on the show.

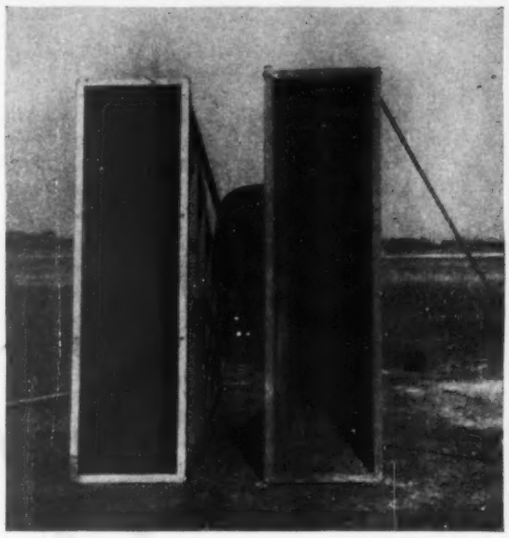
No official word has yet come from Washington concerning the tests, so it is encumbent on your editor to draw his own conclusions, for which he assumes responsibility. In our opinion the tests showed definitely that a long and truly straight-line glide path can be generated using horn radiators, with very small amounts of power (of the order of one watt, although somewhat higher power is contemplated for the eventual completion of the system), that the glide path can be indicated without ambiguity on either a cross-pointer meter or a cathode-ray "three-spot" indicator which carries also the compass and gyro indications, and that the 40 centimeter waves used are a completely practical reality for aviation work. On the debit side of the ledger is the fact that the receiving equipment is, in its present form, rather heavy, but since this instrument is strictly experimental and in no way represents an attempt to compact the equipment there is no reason to believe that this problem cannot be solved in commercial engineering practice. From the technical view-

Irving Metcalf and W. L. Barrow, whose horn radiators made the Metcalf ideas practical.

point, one of the most startling aspects of the demonstration was the 40-cm receiver employed in the plane. This receiver displays a sensitivity of 15 microvolts for 1.5 milliamperes (off-scale) indication on the cross-pointer meter. So far as your editor knows, this is a sensitivity which has never before been approached, on these wavelengths, anywhere in radio engineering. The high sensitivity, coupled with stability, is the principal reason why a glide path extending out five miles can be relied upon with a transmitter power not much more than one watt. Thus many of the question-marks concerning the Metcalf-M.I.T. ideas have been removed.

For purposes of demonstrating the effectiveness of the system, the vertical guidance (up-down indication) was by far the most important, so the principal effort was expended in installing equipment for this phase only. The horizontal guidance (left-right indication) may be provided, in the completed system, by nearly identical equipment. At the demonstration the horizontal guidance was produced by a conventional long-wave runway localizer, designed and operated during the tests by the Washington Institute of Technology. As this equipment is conventional, our attention turns to the vertical guidance equipment.

The transmitting equipment consisted of two 40-cm (750-Mc) transmitters feeding two horn structures. The horns, shown in the accompanying photographs, are wooden structures, roughly ten feet high, two and one-half feet wide at the mouth, and 26 feet deep, lined with copper sheeting. The axis of one horn was inclined at an angle of 10 degrees to the ground surface, while the other horn was inclined at an angle of 5 degrees. The pattern of signal emerging from the horns is in the form of a horizontal fan of signal inclined to the earth's surface. The glide path is contained in the overlapping region between the two flat signals. This overlap region makes an angle of about 7 degrees with the earth's surface, but by means of a control in the cockpit, the angle of descent could be set to the normal glide angle of the airplane, which in these tests was 3 degrees to 4 degrees. The two horns are fed with signals of approximately the same wavelength but with different modulation, 90 cps in the upper beam and 150 cps in the lower. These signals, when received, are rectified to produce direct currents which control the vertical indicator, the indicator moving upward with 90 cps modulation and downward with 150 cps modulation. The center position of the indicator is assumed when the 90 and 150 cps modulations are received with equal strength, that is, when the plane is in the overlap region.



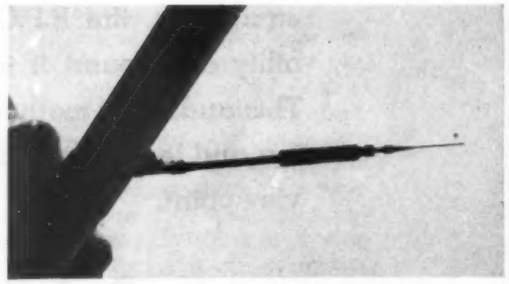
Front view of the horns. The fans of signal spread out horizontally from the horn mouths.

on 40 Centimeter Waves

The transmitting equipment

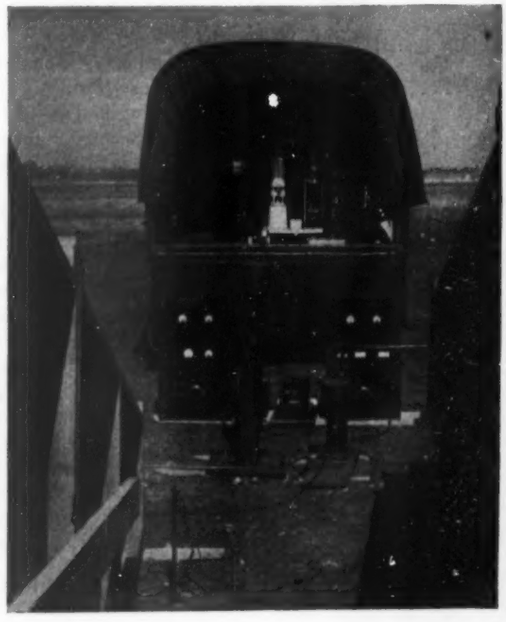
The throat of each horn is closed by a box-like structure within which the transmitting antenna proper is contained. The antenna is a quarter wavelength long (10 cms, roughly 3 inches), and is end-fed from a coaxial line which leads to the transmitter proper. Two forms of transmitter are available, but only one was used in the demonstration of the glide path. The two types are, first, the klystron generator which is capable of delivering high power (up to 300 watts) at 40 cms and, second, the ordinary triode oscillator which is limited to much smaller power output. The klystron was set up in a truck, complete with power supply and vacuum system, and was fitted with a mechanical modulator, and at the time of the demonstration was so adjusted as to be capable of delivering some 50 watts output. The M.I.T. group reports that during exploratory flights of a single beam using the klystron as a transmitter with 50 watts output, extremely strong signals were observed at a distance of 25 miles at an altitude of 2000 feet. This indicates that a range of 50 or 75 miles could be obtained easily, or on the other hand, that a less elaborate receiver could be used with a lesser range. However, such high power was not needed for the glide path demonstration, so two triode oscillators, were set up each using the Western Electric 316A "door-knob" type u-h-f triodes. With about 400 volts on the plates, these tubes could deliver approximately one watt at 700 Mc. The oscillator circuits consisted of coaxial line seg-

(*Turn to page 78*)



The "hypodermic" antenna used for reception.

The power generating equipment; klystron in the truck, triodes on the ground.



Financing Air Transports

When the banks refused to finance airline equipment, the R.F.C. accepted the responsibility and found it to be a good investment. This and other methods of equipment purchasing and leasing are discussed from a financial viewpoint.

By Selig Altschul

WITH new highs in passenger travel constantly being made, the air transport industry may be forced to embark upon an extensive equipment acquisition program.

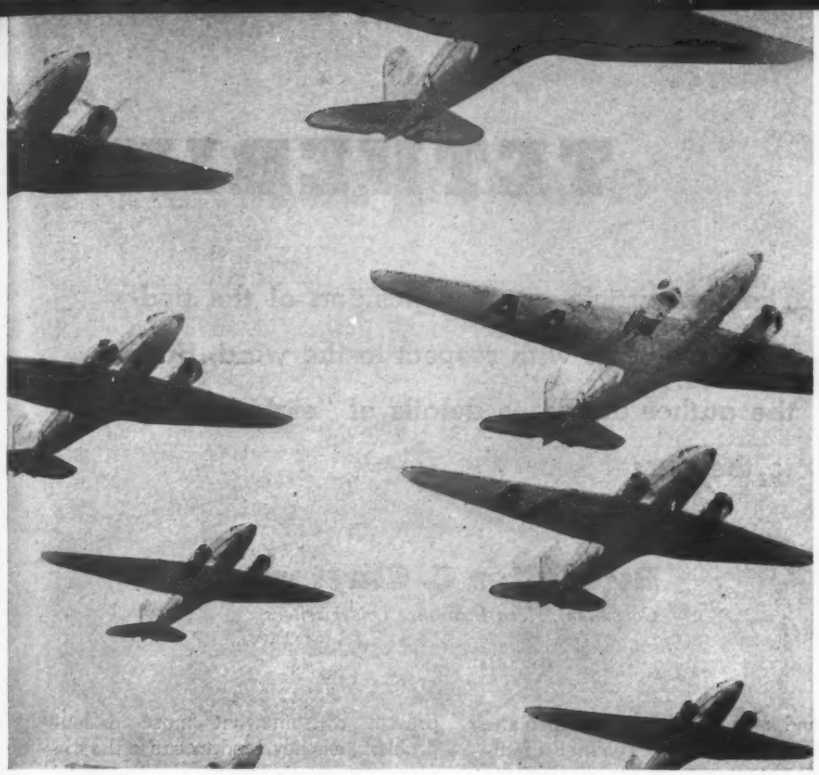
Financing of new equipment purchases need not be a serious problem even to those carriers with depleted cash resources.

Recently, a member of the Civil Aeronautics Authority stated that air transportation has "come of age financially as well as technically". This statement was inspired by the ease in which Pan American Airways financed the purchase of its fleet of new Boeing Super-Clippers, largely through the sale of equipment trust certificates. The present day attractiveness of these aviation certificates is in marked contrast to the attitude assumed by the banking fraternity when the idea was first broached a number of years ago by the air transport industry.

When American Air Lines embarked upon its ambitious equipment buying program late in 1935 and early in 1936, the banks refused to finance the purchase of transport planes on the ground that aviation was too risky and that the resale market for used planes was limited. Whereupon, American applied to and obtained from the Reconstruction Finance Corporation total loans of $1,236,000 at 5 per cent to finance its initial purchase of 20 Douglas D.C.3's, costing $2,060,000. The company's equity in this equipment at the outset was 40 per cent. The R.F.C. took a chattel mortgage on the equipment and provision was made to amortize this indebtedness over a four year period through monthly payments. During 1937, an additional $618,000 was borrowed from the R.F.C. on the same basis and under the same terms to finance the acquisition of 10 additional D.C.3's valued at $1,031,000. Cash from earnings charged to depreciation was used almost entirely toward the retirement of the R.F.C. loans. Monthly installments have been prepaid well into 1940. Only about $93,000 was due at the end of 1938, compared with about $1,425,000 as of December 31, 1937.

Northwest Airlines, Inc., in April of this year also accepted a R.F.C. loan to finance the acquisition of 6 new D.C.3's. A total of $480,000 was borrowed and secured by chattel mortgages on the new planes and other miscellaneous equipment, all having an indicated value of approximately $880,400. Although the Northwest credit closely patterns the American Airlines transaction, it is of particular significance as it is the first loan to be approved under section 410 of the Civil Aeronautics Act. This section empowers the Authority to approve or disapprove applications for loans or other financial aid from any Federal agency to an air carrier. Moreover, the CAA must prescribe the terms and conditions upon which such loans are granted. For this reason, important precedents for future loans of this nature may be found in the details of the Northwest transaction.

Provision is made for the retirement of the loan in monthly payments of $12,400 beginning six months after the date of the loan, the balance to be paid in four years. All payments are



to be applied first on the interest and then on the principal of the loan. On an amortized basis, the indicated annual interest rate is slightly more than 2 per cent, probably the lowest on record ever charged an airline.

The R.F.C. was given the right to approve any compensation in excess of $4,800 annually to be paid any individual (other than pilots) associated with the company. Pilot salaries in excess of the minimum standards established by the National Labor Relations Board must also be approved by the R.F.C.

Collateral requirements of at least 166⅔ per cent of the amount of the loan was specified. (Actually—Northwest gave a mortgage on total property having an estimated value of about 183.5 per cent of the amount of the loan).

Much simpler was the financing arrangements used by Transcontinental and Western Air, Inc. in the acquisition this past April of 3 new D.C.3's aggregating $323,125. A total of $300,000 was borrowed from a New York bank at 3 per cent. The notes are to mature serially with $100,000 falling due October 1, 1939 and four installments of $50,000 each on April 1 and October 1 of 1940 and 1941.

The first true aviation equipment trust financing, similar to the "Philadelphia Plan" used in the railroad industry, occurred on January 3, 1939, when Pan American Airways, in order to finance its new Boeing Super-Clippers, arranged for the sale of $2,500,000 in 4 per cent equipment certificates to two New York banks. Subsequently, an additional $1,000,000 of certificates were sold to an insurance company. Pan American paid 30 per cent of the purchase price of the planes in cash, the remaining 70 per cent becoming available through the sale of the certificates. Pan American Aviation Supply Corp., acting as vendor, acquired the planes from the manufacturer and transferred them to the trustee, the New York Trust Company. The total crash insurance to be maintained should afford ample protection. The certificates will mature serially on a semi-annual basis from January 1, 1940 to January 1, 1944. In this manner, the company purchases its new equipment on a "pay-as-you-go" basis and at the end of five years will have acquired full title to the planes.

The chief difference between equipment trusts for railroads and the issue established for PAA is that the period to final maturity for railroad equipment trusts extends over 10 or 15 years, whereas for the new planes of Pan American, the term is limited to 5 years. The principle involved is the same, i.e., payments by the operating company shall have retired, during the useful life of the equipment, the entire amount of the securities issued.

The historical record of railroad equipment trust certificate is such that this type of security has proved to be a highly desirable holding in spite of the low credit position to which many railroads have sunk. Since 1868, of the approximately $4,000,000,000 principal amount of equipment obligations issued by U. S. railroads, all but about $550,000,000 or 13.7 per cent had been retired as of January 3, 1939. With the possible exception of the obligations of domestic governmental bodies, no other type of security has had a better record as to the payment of interest and principal when due.

Moreover, railroads wishing to borrow toward the purchase of rolling stock, in most cases can do so at considerably lower rates of interest than prevailed when the railroad industry was prosperous.

It is highly significant that the railroad industry, which many consider to be in a decadent stage, is able to finance new equipment acquisitions with the greatest facility. That bankrupt carriers can so obtain credit accommodations is recognition of the basic soundness in the financing methods used. These same financing principles can be applied with equal effectiveness to the air transport industry.

Basically, the inherent strength of equipment trust obligations is present in the indispensable character of rolling or "flying" stock to the carrier's operation. The right of way, roadbeds, terminals and other properties, although essential to the operation of a railroad, have very little value without rolling stock. Similarly, an airline may have a franchise for a valuable route, but it is non-productive without the necessary flying equipment. In normal railroad operations there is considerable interchange of equipment between various roads regardless of geographical location. Due to the essential nature of this equipment, and its standardization and ready interchangeability, an obligation based upon its ownership reflects less the fortunes of the individual carrier than does any other railroad obligation. This same condition, can, with equal force, apply to the air carriers. With many of the airlines flying similar equipment, interchangeability of planes should be an added factor in providing greater market-ability for used transports, thus affording greater security for paper issued on this type of equipment. The practical application of the interchangeability of equipment was demonstrated when United Air Lines leased a number of its Douglas D.C.3's to the Eastern Air Lines on a seasonal basis. American Airlines, too, used the leasing principle, when it loaned Northwest Air-

(*Turn to page 80*)

TETHERING

The first article covered position of the tied-down airplane with respect to the wind. Here the author discusses details of "making fast" to the plane.

Part II

Part I appeared in October

By Walter C. Clayton
Consultant, Aero Insurance Underwriters

IF THE PILOT is forced to land away from his base at some field where there are no facilities whatever, there is indeed a serious danger of loss due to wind. If weather conditions indicated that there would be no immediate change it might be adequate to leave the airplane standing with the wheels blocked or parking brakes set. It might, however, be well under such circumstances to note the reading of the altimeter at the time of landing and check it occasionally to see if there is any noticeable change in barometric pressure. As an altimeter and a barometer are fundamentally the same, the altimeter makes a fair barometer, except that the scale is quite small. A falling barometer is indicated by an apparent increase in altitude. Any rapid change in barometric pressure is generally accompanied by an increase in wind velocity.

In the case of bad weather while the airplane is out in an unprotected place without the benefit of ropes and stakes, it would probably be advisable to dig fairly deep pits in the ground into which the wheels could be rolled. This would supply excellent blocking for the wheels and at the same time reduce the angle of attack of the wings. If the weather is stormy it might be desirable to actually fill earth back into the pits around the wheels. If this is done care should be taken to protect the wheel bearings and brakes against dirt.

The question of wind gusts is one that must be given consideration. In flight, the gusts may act in any direction, that is, vertically, laterally, or in the direction of flight. A gust in the direction of flight tends to momentarily increase or decrease the relative wind velocity. The effect is of course substantially the same as a vertical gust. That is, it will tend to either increase or decrease the lift with resultant upward or downward acceleration of the airplane. A lateral gust will tend more to effect the airplane in rolling and yawing (change of direction). On or near the ground the vertical gusts will be dampened out to a considerable extent by the proximity of the ground. Consequently the gusts will make themselves evident primarily in the form of variations in the intensity of the gusts and variations in the lateral direction of the gusts. If the airplane is tethered so that the wings are substantially at an angle of zero lift, the only appreciable effect that variations of intensity will have if the wind is substantially from the direction in which the airplane is pointed, will be to increase the drag of the airplane. This is of very little importance provided that the wheels are suitably blocked. The gusts of wind that strike the airplane laterally present a somewhat more difficult problem, as they tend to cause the airplane to weathercock into the wind. The tail of the airplane should therefore be tied down so that it will be kept in contact with the ground or pedestal and so that it cannot move laterally to any extent. Lateral wind or gusts play another part, particularly when the wings have an appreciable amount of dihedral. The wind gets under the wings and lifts the windward wing, tending to roll the airplane over laterally. To prevent this possibility, the wings should be tied down firmly so as to prevent appreciable rolling of the airplane. If this is not done the windward wing will tend to lift up, increasing its angle to the wind, thus further increasing the tendency for it to roll.

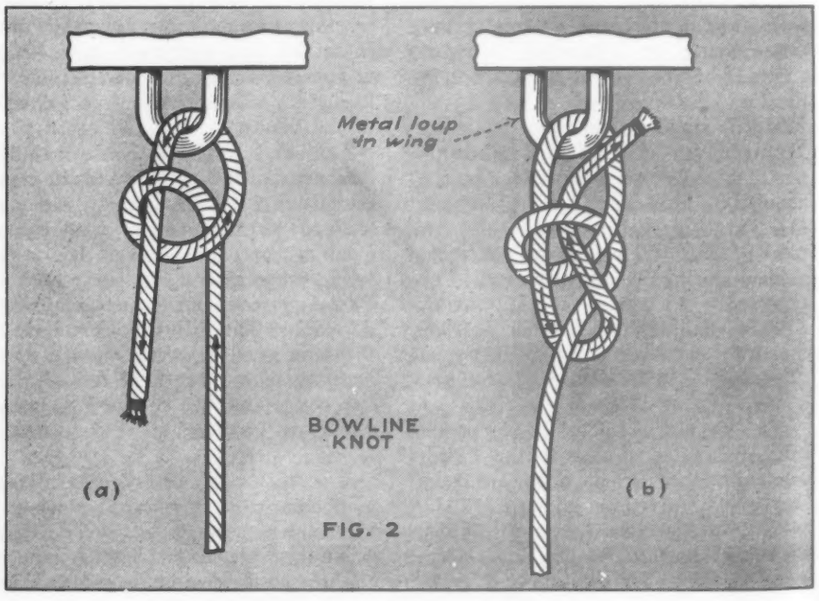


FIG. 2

the Airplane

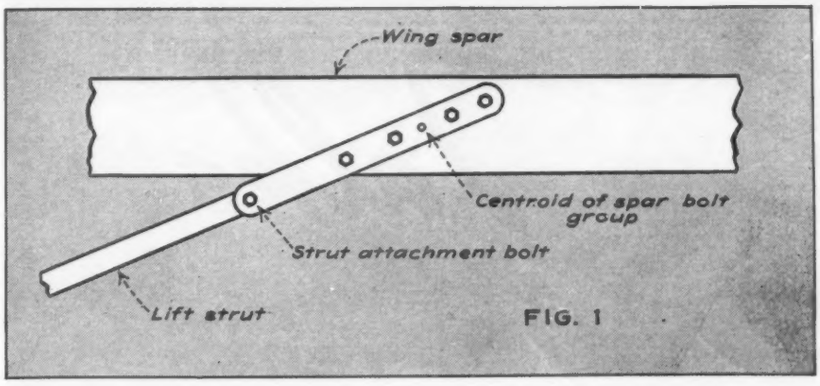


FIG. 1

In tethering aircraft it is probably advisable to locate the plane either right up close to a building or else completely clear of buildings or other obstructions. While in the lee of a building or hangar an airplane would doubtless receive considerable protection, one must not lose sight of the fact that there is a possibility of the wind shifting and of the airplan being only partly protected from the wind. Buildings or other obstructions cause considerable turbulence and if the wind were to change in such a manner that one wing of the airplane were exposed to the wind and the other wing only partly exposed, there would be considerable dissymmetry of forces on the airplane which might be more undesirable than larger forces distributed uniformly over the entire airplane. In any case it would be undesirable to tether an airplane near the corner of a building. Under no circumstances should an airplane be tethered in front of a hangar door where it might interfer with the removal of airplanes from the hangar in case of fire. Also because of the fire hazard airplanes should not be tethered too close together.

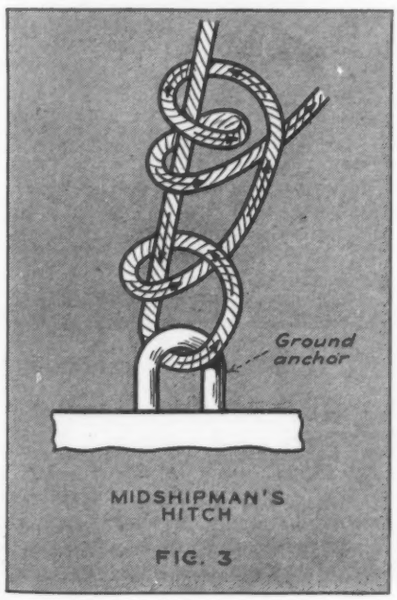


FIG. 3

Ground gusts are very largely dependent upon the surrounding terrain. Rough terrain usually results in considerable turbulence of the air. It would be inadvisable to tether an airplane any where if due to the terrain there were very rapid and violent changes in the direction of the wind.

When aircraft are tethered out, the operator should be careful to check with the weather bureau concerning weather conditions. In general, more windy gusty weather is to be anticipated in the spring than any other time of the year with the possible exceptions in the summer of occasional thunder storms. The Spring gusts are doubtless due in a large part to the difference in air temperature and ground temperature. The air and the ground are both cooled during the Winter months. In the Spring the ground temperature warms up more rapidly than the air, the resulting convection currents causing gusts.

Table I below gives the Weather Bureau's classification of wind velocity.

Another method of indicating wind velocity is the Beaufort scale used in marine work. Under the Beaufort scale, numbers are given to indicate the intensity of the wind. Table II is the Beaufort scale.

Suitable means should be provided in the wing itself for tying down the airplane. Probably the best arrangement is a steel loop or ring about two-thirds of the distance out from the center line of the airplane to the wing tip, installed either on the front or rear spar, preferably the former. In the case of airplanes having external bracing, the logical place to mount such a loop would be at the outer strut point on the under side of the wing. Many manufacturers make such provisions. Some, unfortunately, have not been made strong enough for the purpose intended, with the result that failures have occurred. Some operators have, as a result, lost faith in this means of tethering. Where such loops have not been installed, airplanes have been damaged by personnel improperly tying them down. Frequently a rope has been looped around a strut, this being the most accessible place. In the case of high-wing aircraft using lift struts, ropes have been frequently tied to the upper ends of the struts. These at times have slipped down to the middle of the strut with the result that the loads have buckled the struts. It might be pointed out that even though the rope were attached to the upper end of a lift strut, that this still may be unsatisfactory as far as the fitting itself is concerned. The fitting was designed to take loads in the direction of the strut and not at right angles to that direction. Because of this, it is possible for large moments to be set up in the strut fitting by the rope. The ring should be so attached that the rope load passes substantially through the centroid of the spar fitting bolt group. (See Fig. 1)

The fuselage of the airplane should similarly have adequate provision for

(*Turn to page 76*)

Table I

Wind Velocity in MPH	Classification
1–12	Light and Gentle Wind
13–18	Moderate Wind
19–24	Fresh Wind
25–38	Strong Wind
39–54	Gale Force
55–75	Whole Gale Force
75 and Up	Hurricane

Table II

Beaufort Numbers	
0	0 to 2 MPH
1–3	2 to 12 MPH
4–5	13 to 23 MPH
6–7	24 to 37 MPH
8–9	38 to 55 MPH
10–11	56 to 75 MPH
12	Above 75 MPH

With rapidly rising backlogs, the aircraft manufacturers are more interested than ever in production problems

By Charles F. McReynolds

WITH American aircraft production swinging into new high ground, the 1939 S.A.E. National Aircraft Production Meeting found a ready response among the aircraft people of the Pacific Coast. In line with recent record production rates of various aircraft plants, the papers presented at the various sessions established an enviable mark for exposition of detailed procedures such as are often considered "trade secrets" even within the ranks. As one interested listener remarked; "This has been a 'million-dollar' series of lectures." The attendance matched the merit of the papers, with 875 persons enrolling at the S.A.E. desk and that many more believed to have been in attendance but not registered.

Almost every session found the hall packed to the gills and a conservative estimate of total attendance for the three days would be in the neighborhood of three thousand persons.

Keynote of the current condition in our aviation industry was sounded by Brigadier General Jacob E. Fickel, March Field commander, who reported on the progress of the President's air expansion program, with the assurance that the industry has met every demand for increased production and is currently much farther along with the program than was at first thought possible. General Fickel concluded with the statement, "We . . . know that with the increased facilities and larger appropriations for research and experimentation now available, that this country will remain in the lead in advanced design, and will meet any challege for supremacy in the air." Gen. Fickel spoke in place of Louis Johnson, Assistant Secretary of War, who had originally been scheduled to come to Los Angeles to address the session. General Fickel was introduced by Robert E. Gross, president of the Lockheed Aircraft Corporation, who referred to present world conditions as "The one immortal hour of our lifetime . . . when the history of the world is being written not in the chancellories of nations, but on the drawing boards of aviation engineers." Gross reminded his hearers of the fact that commercial

Robert E. Gross, president Lockheed Aircraft Corp.

and military aviation have equally affected our lives, saying, "The airplane has made of nations a neighborhood; but it has made the world a battlefield."

The meeting closed with a banquet and grand ball on Saturday evening at the Biltmore Hotel, home of the sessions. Some five hundred of aviation's leading personalities turned out for this social function, which was devoted entirely to banqueting and dancing, except for a brief speech of welcome by E. W. Templin, chairman of the Southern California Section of the S.A.E., hosts of the session.

This year an aircraft engineering exhibit was held in connection with the production meeting. Taking over a large hall adjoining the ballroom in which the sessions were held, a representative group of manufacturers displayed their products and found a responsive audience. Those exhibiting at the engineering show were: Aircraft Accessories Corp., samples of the hydraulic equipment manufactured, also equipment built by the Thos. L. Siebenthaler Division; Aircraft Precision Products, Inc., a very complete line of sample parts representing work done on a contract basis for the various aircraft plants; Aluminum Company of America, a large number of sample parts representing the latest work in aluminum casting, forging, welding, extrusions, etc.; Aluminum Industries, Inc., sample of Aluminum alloy castings; Bantam Bearings Corp., a complete line of aircraft bearings; Baldwin-Southwark Corp., a laboratory testing machine for determining strength of materials in either compression or tension; Bendix Products, a display of typical Bendix accessories as used throughout

(*Turn to page 84*)

L. to R.—Palmer Nichols, Bendix of Calif.; Mac Short, Vega Airplane Company

L. to R.—L. B. Grant, Dow Chemical Co.; Brint Edwards, session chairman; G. D. Welty, Aluminum Co. of America

L. to R.—Mac Short, Vega Airplane Company; John A. C. Warner, S.A.E.

L. to R.—H. K. Cummings, Bureau of Standards; Ashley C. Hewitt, Ind. engineer

L. to R.—O. C. Bridgeman, C. F. R. Project, H. C. Hill, Wright Aeronautical Co.; Robert Insley, Pratt & Whitney Co.; A. T. Gregory, Ranger Engineering Corp.

L. to R.—Left rear, C. E. Stryker, Bendix Aviation; Left front, Dr. A. L. Klein, California Institute of Technology; T. P. Wright, Curtiss-Wright Corp.; Harold W. Adams, Douglas Aircraft Co.; Henry H. Kerr, Bendix Prod. Div., Bendix Aviation; Mac Short, Vega Airplane Corp., General Chairman SAE meetings.

A Production Expert Expresses His Views On

Planning for PRODUCTION

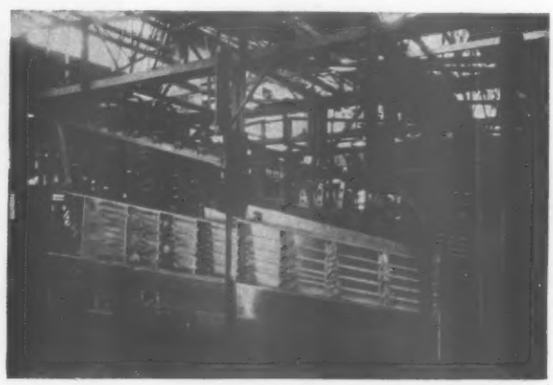
Being an excerpt from a paper entitled "Accelerated Aircraft Production for National Defense"* by

P. N. Jansen

Factory Manager, Curtiss Airplane Division, Buffalo, N. Y.

WITH the transition from stick and wire design to present day construction comes the need for a different approach to the manufacturing and organization lineup. Practically all parts normally manufactured by airplane companies receive their primary operation in three manufacturing groups, namely shearing, press and machine shop. Nearly all parts require tools, even in small quantities. This reflects back in many ways and I believe that recognition of fundamentals in these changes will tend to work an easier solution.

Geographic location of activities is more important and should be recognized in plant layout. Organization and the human element are of extreme importance. Before, the line and staff organization prevailed and gave us satisfactory results, but we are now blending into the truly functional type of organization. This provides for the specialist and when properly carried out will present a great aid to rapid expansion. Whereas in the past the average first-class man used to make his own templates and layouts, this is now concentrated in a loft or layout department. Where we used to mix fabricating with assembly, there is now a strict separation with all groups carefully departmentalized. Shop orders are augmented by operation sheets with the ultimate aim of supplying operators with accurate information, tools and materials. All this has deep significance. It shortens the training period at least for the vast majority of workmen because the application of knowledge and skill is confined. The advantages for national defense are far reaching. However there are dangers and possible drawbacks. Weakness in any group can do great harm and the existence of incapable management which does not fully grasp the fundamentals or fails to recognize the need for close coordination, will cause confusion. We still need skilled tradesmen in the aircraft industry but the training problem is easier because of specialization. With some trained men in all positions, as outlined before, many young men with high school education can become fairly proficient in repetitive operations, drilling, riveting, in short time.



The main assembly fixture on which the wing is completed and then removed. There are numerous additional assembly tools not shown here. All assembly jigs are designed so that they do not require dismantling for removal of units. They are made with removable parts and are hinged and chained to avoid losses.

The Human Element

The human element offers its problem and it is essentially a moral obligation to recognize the effect on personnel that arises with the introduction of a new order. An operator, especially one on minor operations, does not feel as secure because he can readily be replaced. The more specialization, the more demand for seniority rules and the rate question has been similarly affected. Men with years of experience and service may do the same repetition job, sometimes not as well, as a youngster with six months' experience. The older man may at

* Complete paper as presented at the Aircraft Production Meeting of the Society of Automotive Engineers, Los Angeles, California, October 5–7, 1939.

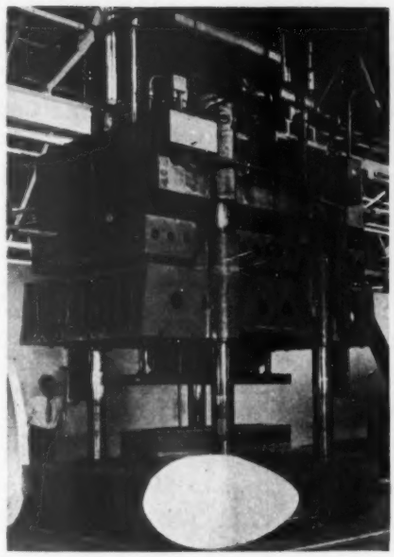
some other time utilize his skill and experience but in the meantime the youngster wonders why he cannot earn the same rate for the same work. There is no cure-all but the problem is there and at least a partial solution must be worked out. It is easy to raise wages—very difficult to cut—and you cannot fire everybody whose rate seems to be high by comparison.

A partial solution of the comparative rate question has been found through the setup of a job evaluation plan. It means a lot of hard work with so many different occupational groups found in an airplane manufacturing plant and at first is difficult to sell. However, since we have had it in effect for a few months the men like it and I do not see how we ever worked without it. The problem of overpaid men we trace to three causes: age and health and general slowing down; no further need for his trade or experience and just plain overpaid through poor classification. Each require a separate treatment; the first, transfer to an easier job with less pay; the second, transfer to jobs in which his knowledge can be better applied without reduction in pay; the other, through education to bring him within his classification for pay received, otherwise reduction or discharge. I find that a fair minded committee, including shop people, can handle most cases with reasonable success. I believe that everything we do must gradually arrive in a groove and the personnel problem is farthest from it, which is natural. There again, the functional organization idea comes into play through centralizing and coordinating the personnel problems through a well set up personnel department.

Planning and Control

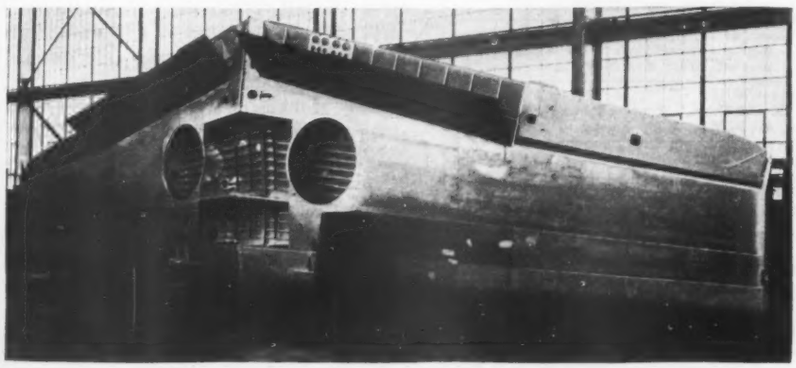
We now go back to the material side, namely planning and control. Increased quantities, type of construction and cost of material calls for planning and control. There is no time to discuss such a lengthy subject in all its ramifications but the fact remains that production control is an inescapable necessity, although we all

(*Turn to page 80*)

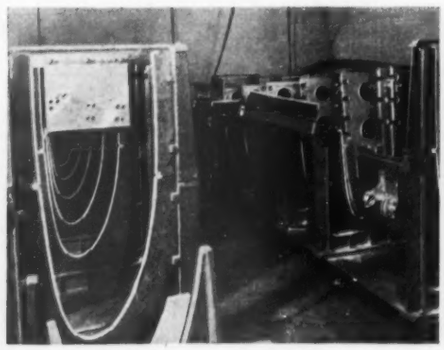


A double-acting hydraulic press of 700 tons capacity; 500 tons capacity on the primary ram and an additional 200 tons for the pressure pad.

When the wing is completely assembled it is placed on a truck and taken to the Panel Department and not removed until ready for final attachment to the fuselage. Tests of each unit are made while the wing is in the vertical position on the same truck. The completed fuselage is handled in a similar manner.



Assembly in the wing web.



The main aisle through the Buffalo plant of Curtiss-Wright. This is twelve feet wide and is parallel with two eight foot aisles dividing the main building into four parallel bays. These are intersected with four through cross aisles, providing clear cut traffic facilities.

MAGNESIUM SHEET

Table I. Compositions and Characteristics of Downmetal Alloys

Alloy	Nominal Compositions — Per Cent					Relative [1] Resistance to Salt Water	Characteristics and Uses
	Aluminum	Manganese	Zinc		Magnesium		
A	8.5	0.2	...		Remainder	D	Sand castings. Replaced by Dowmetal H. Press forgings and extrusions. Replaced by Dowmetal O.
B	12.0	0.1	...		Remainder	D	Sand castings. Replaced by Dowmetal P.
E	6.0	0.2	...		Remainder	E	Plate and Sheet. Improved mechanical properties compared to Dowmetal F. Weldable.
F	4.0	0.3	...		Remainder	E	Plate and sheet, and certain thin-walled extruded sections and tubes. Replaced by Dowmetal J and Dowmetal X for most extruded sections, and by Dowmetal E for plate and sheet. Weldable.
G	10.0	0.1	...		Remainder	D	Sand castings. Replaced largely by Dowmetal H. Weldable.
H	6.0	0.2	3.0		Remainder	B	Sand castings and forgings with improved salt water resistance. Heat treatment not required for general use, but may be heat treated to secure high strength and toughness or heat treated and aged to secure high yield strength with moderate toughness. Limited weldability.
J	6.5	0.2	0.7		Remainder	D	Press forgings, extruded bars, rods, and shapes of improved strength and salt water resistance. Weldable.
J-1	6.5	0.2	0.7		Remainder	B+	Same as Dowmetal J but made with low iron and nickel impurities to conform to present Army and Navy Specifications.
K	10.0	0.1	...	Silicon 0.5	Remainder	B	Die castings. Replaced largely by Dowmetal R.
L	2.5	0.3	...	Cadmium 3.5	Remainder	D	Hammer forgings. Improved forgeability and salt water resistance compared to Dowmetal F. Weldable.
M	....	1.5	...		Remainder	A	Plate and sheet, extruded sections, sand castings, and forgings of moderate strength and best salt water resistance. Weldable.
O	8.5	0.2	0.5		Remainder	E	Simple press forgings and extruded sections of high yield strength. Weldable.
O-1	8.5	0.2	0.5		Remainder	B	Same as Dowmetal O, but made with low iron and nickel impurities to conform to present Army and Navy Specifications.
P	10.0	0.1	1.0		Remainder	C	Sand castings. Has improved salt water resistance compared to Dowmetal B. Used only in heat treated and aged condition to secure maximum yield strength and hardness for applications not subject to shock. Weldable.
R	9.0	0.2	0.6		Remainder	B	Die castings. Good casting characteristics combined with best mechanical properties. Weldable.
X	3.0	0.2	3.0		Remainder	B	Press forgings, extruded bars, rods, and shapes with best combination of properties and resistance to salt water. Can be aged after forging or forming. Limited weldability.
X-1	3.0	0.2	3.0		Remainder	B+	Same as Dowmetal X, but made with low iron and nickel impurities to conform to present Army and Navy Specifications.
EX	6.5	0.2	...	Silicon 0.2	Remainder	B	Die castings. Moderate strength with high toughness for parts subject to shock. Weldable.

[1] "A" rating is the highest. In ordinary atmosphere the various alloys are approximately equivalent and have very good resistance.

An excerpt from a paper "Production of Magnesium Alloy Aircraft Parts"*

By

L. B. GRANT

The Dow Chemical Company

THE extremely light weight of magnesium alloys (specific gravity 1.8) is well-known and a proper knowledge of their properties, design, uses, and methods of fabrication will enable the aircraft engineer to save many pounds of needless weight. The procedures incidental to the use of magnesium alloys are not unduly difficult or complicated, but until recently engineers in this country have been prone to use and treat magnesium alloys exactly like aluminum with the result that in some cases trouble was encountered and magnesium was given the reputation of not being suitable for that particular application. These difficulties were caused both by lack of interest on the part of the aircraft industry and by a lack of sufficient knowledge on the subject.

(*Magnesium alloys have a wide variety of composition and uses, as detailed in Table I. The portions of the original paper included herewith, however, cover only the composition, treatment, and use of magnesium alloys in sheet form, as detailed in Table II. In visiting German aircraft factories last year an extensive use of magnesium sheet for fairings, wing-root fillets, etc., was observed.* —ED.)

Magnesium alloy sheet and plate is being used in increasing quantities for aircraft parts and Dowmetal "M" alloy is the most widely used composition in sheet form. This alloy conforms to Navy Bureau of Aeronautics specification No. M-111d alloy No. 11 and Army Air Corps

* Read before the Aircraft Production Meeting of the Society of Automotive Engineers, Los Angeles, California, October 5-7, 1939.

for AIRCRAFT

specification No. 11317. It is available in both hard rolled ("MH") and annealed ("MA") conditions. The composition of this alloy is given in table (1) and its mechanical properties, in table VII. This sheet is supplied to the aircraft companies with the Chrome-Pickle treatment, and it should be retreated with the Chrome-Pickle treatment or the Anodic PT13 treatment after forming and before assembly.

Magnesium alloy sheet can be readily bent, drawn and pressed, although these operations require some changes from present practice on other metals. Dowmetal "MA" sheet can be bent cold around a radii down to 4-t and "MH" sheet can be bent cold around a radii down to about 8-t. If sharper bends than 4-t are required, it is necessary to work the sheet in the temperature range of 500° F to 750° F. Tools should be clean, smooth and well lubricated. Lard oil is generally a good lubricant since it stands the heat well and is readily removed from the formed stock by alkaline cleaners. Successful bending around short radii requires the removal of sharp corners and burrs from the edges of the sheet near the bend line. Bending lines should not be prick-punched, as such marring of the surface may result later in fatigue cracks started from these points.

Magnesium alloy sheet can be successfully hot formed with the regular drop hammers such as are used in the aircraft industry, and either magnesium or aluminum dies should be used instead of the regular lead and zinc dies. This substitution is necessary to prevent pick-up of the die material on the surface of the sheet at the elevated temperatures of hammering. The female die or the bottom die should be heated to about 400° F, and the sheet should be preheated in an oven to about 700° F. In all heating operations, it is essential to keep the temperatures below 800° F to avoid grain growth. Very little spring-back occurs on the hot worked sheet.

Power drawing is being done successfully and the temperatures of working are the same as given above. The speed of drawing should be less than for other metals, and, therefore, hydraulic presses are best suited for this type of work.

Magnesium alloys should be riveted with aluminum alloy rivets, and either 2S or AM55S are recommended. 2S rivets are easy to drive, but should be used only for very thin sheets and for lightly stressed parts. For heavier gauges of sheet and for stressed parts AM55S rivets are especially recommended because of the good strength and because this particular rivet material minimizes electrolytic action and resultant corrosion between the aluminum rivet and magnesium alloy sheet. Rivet holes should be drilled rather than punched in order to obtain maximum smoothness on the edge of the rivet hole. Cone point heads should be used on rivets wherever possible as they require less driving pressure with less resultant danger of cracking of the sheet.

Magnesium alloys can be successfully gas welded with an oxyacetylene torch. Dowmetal "M" alloy is the easiest of magnesium alloys to weld and is, therefore, successfully used for such parts as oil tanks, etc. Dowmetal "J" and "J-1" extruded shapes, bars, and tubes can be welded although not as readily as "M". The welding rod should be of the same composition as the material being welded. A neutral flame should never be allowed to become oxidizing.

Special welding fluxes are required and are available from magnesium suppliers. It is most important that the flux be thoroughly cleaned from the weld immediately after the welding operation because the flux is extremely corrosive. The weld should be washed with hot water and scrubbed with a stiff bristle brush and should then be dipped in a Chrome-

(*Turn to page 82*)

Table II. Mechanical Properties of Downmetal Plate and Sheet

Alloy	Condition [1]	Tensile Strength lb./sq. in.		Yield Strength lb./sq. in.		Elongation in 2 in. Per Cent		Rockwell E Hardness	Brinell Hardness	Bend Radius	
		Typical	Specified Minimum	Typical	Specified Minimum	Typical	Specified Minimum			Typical	Specified Maximum
E	Hard Rolled (Eh)	45,000	39,000	34,000	28,000	9	3	81	70	7+	....
	Annealed (Ea)	39,000	42,000 Max.[2]	20,000	.....	15	10	68	57	...	3+
M	Hard Rolled (Mh)	37,000	32,000	27,000	24,000	9	4	64	53	7+	....
	Annealed (Ma)	32,000	35,000 Max.[2]	16,000	.....	15	12	56	48	...	3+

Yield strength is defined as the stress at which the stress-strain curve deviates 0.2% from the modulus line.
The property values above apply to thicknesses of 0.016" through 0.250". Thicker material may deviate somewhat from these values.
By maximum bend radius is meant that material should take without fracture a bend around a radius of 3+ or less. This determination is made on one inch samples in thickness up to No. 8 B. & S. gauge. Larger radii should be used in the shop as determined by trial.
[1] Unless the temper is specified, the above alloys will be furnished in the annealed condition.
[2] Specified as maximum to insure complete annealing.

Table III. Downmetal Magnesium Alloys

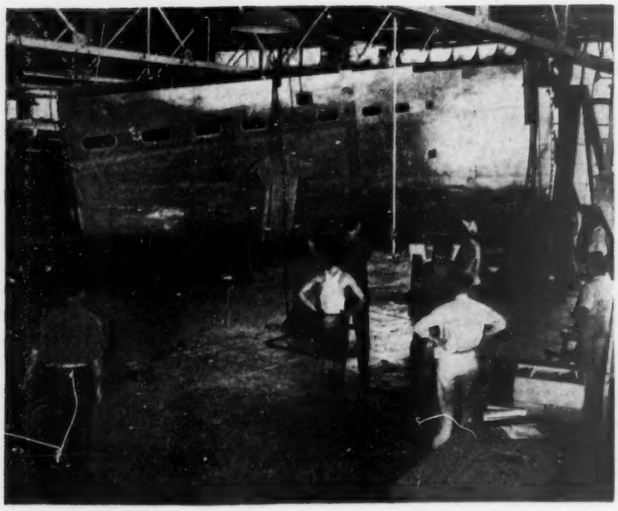
Index to Specifications

Form	Dowmetal	A.S.T.M.		Bureau of Aeronautics		Army Air Corps	
		Alloy No.	Specification No.	Alloy No.	Specification No.	Alloy No.	Specification No.
Sheet and Plate	F	6	B90-38T	..	.....	....	.....
	E	7	B90-38T	..	.....	....	.....
	M	11	B90-38T	11	M-111d	....	11317

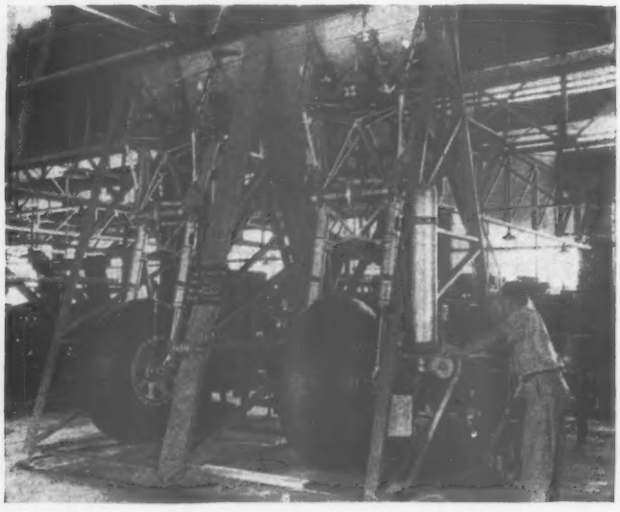
Curtiss-Wright "CW-20" Emerges

November first is expected to see the assembly of the major units of the new luxury liner now in the final stages of construction. The fuselage is waiting attachment of wings, tail and landing gear before rolling out of the factory.

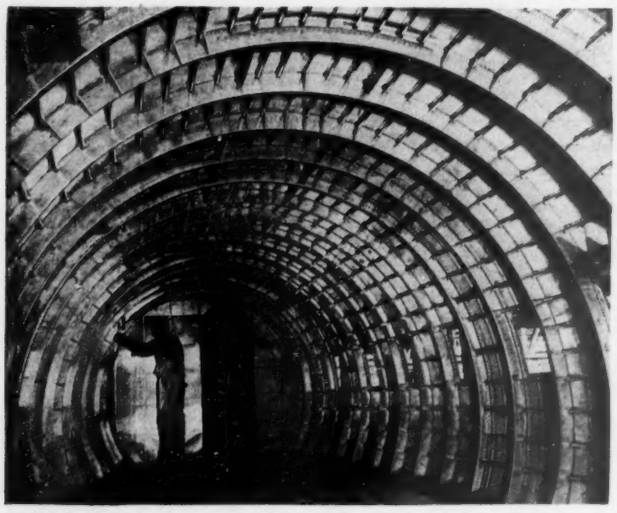
Flying Equipment



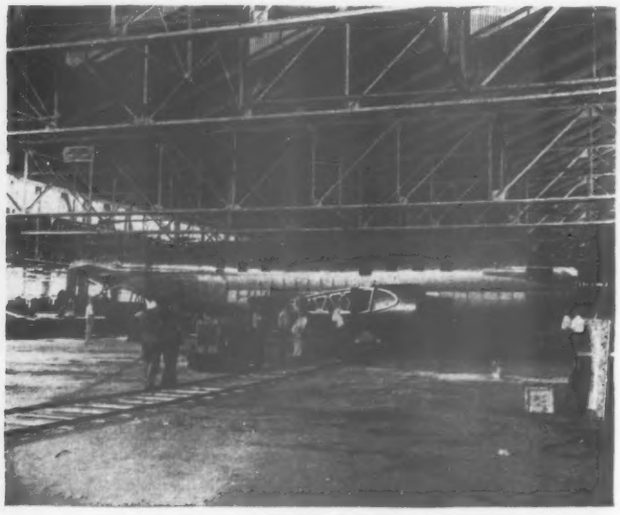
One of the flush riveted wing panels of the Curtiss-Wright transport being removed from its jig by an overhead crane for transfer to the final assembly department where it will be attached to the fuselage. The development of a new slotted flap which may be used in suitably extended positions for take-off and single engine flight, and landing, improves efficency.



The hydraulic, fully retractable landing gear has been subjected to a long series of operating tests. Nominal diameter of the main landing gear tire is 55 inches. The oleo struts have a long stroke sufficient to withstand a drop test of 33 inches, equivalent to a 800 foot per minute rate of descent. Wheels are well forward on the CW-20 design.



Not a close-up of the Holland Tunnel, but a picture of the unfinished passenger cabin of the Curtiss-Wright 20. The fuselage will accommodate 36 passengers, a crew of from three to five and 550 cubic feet of mail, baggage, and express. Through the door, in the rear, may be seen the circular bulkhead for pressurizing the cabin.



Rapidly nearing its flight stage, the new 36-passenger Curtiss-Wright Transport is being moved over its specially constructed assembly line track into position for the attachment of landing gear, wing panels, tail surfaces, and two 1600 hp. Wright Double-Row Cyclone engines. The new airliner is twice the size of a railroad freight car.

TWO MILLION MILES BEYOND THE MOON!

THAT'S how far would reach the mileage flown by Stinson 105s since their introduction five months ago—a total distance of more than 2,250,000 miles, in the United States and Canada, and in Central and South America . . . with a safety record that is remarkable in the history of aviation *(the 105 is the only plane in its class with slots, flaps, hydraulic brakes and other safety features)* . . . and with operating costs which prove conclusively this new Stinson plane is *extremely* economical!

Reliability, safety, low maintenance, beauty—these are the reasons the three-passenger 105 is proving so popular for private flying. And the initial cost is surprisingly low—only $2995.* Low cost finance plan available.

Prominent Air Schools which offer the finest equipment have found that students willingly pay more to fly the "105". This is why these schools are selecting Stinson 105s for their C.A.A. Training Program.

Write today and arrange for a demonstration. Find out for yourself how easy and safe and inexpensive it is to fly the Stinson 105.

*Including Federal taxes, not including state or local taxes.

SEND FOR THIS. *Ask for a free copy of the Stinson Plane News. It gives complete specifications of the 105.*

STINSON AIRCRAFT DIVISION

Manufacturers of Quality Airplanes for Airlines and Private Fliers Since 1926

WHAT'S a loss of a day's schedule cost? Figure it up! Ships don't make money on the ground! Today there is no excuse for the winter losses of the airlines. Fields *can be* cleaned rapidly and at low cost. Properly cleaned fields can be turned to a sales asset with travelers. Snow delays, snow dangers can be reduced.

Snogo removes the snow right down to the runway, throwing it up to 100 ft. clear of the runways regardless of depth. No dangerous banks to catch wing tips or trap snow into ever deeper rowing lanes, no pot holes to the take-off.

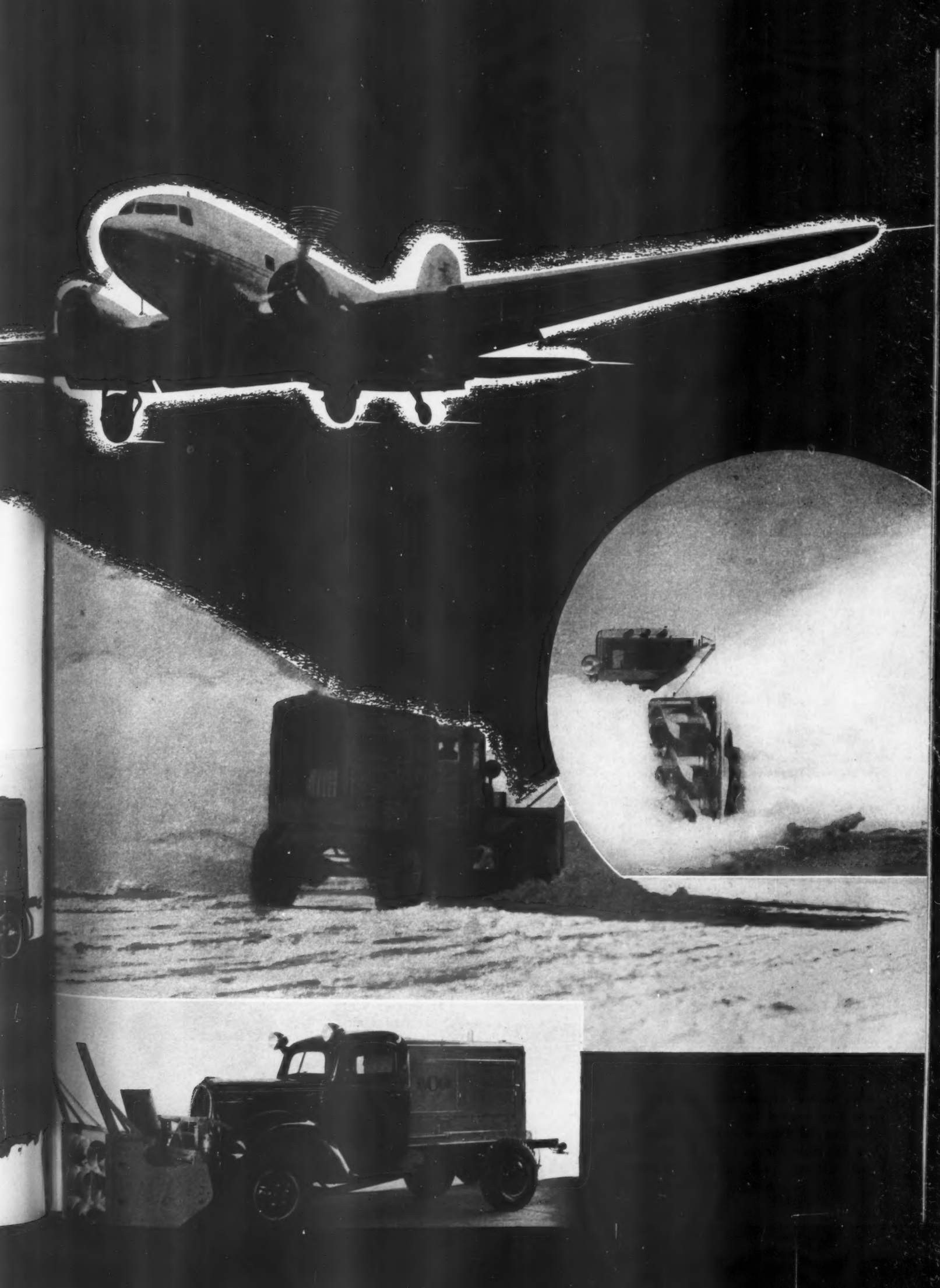
Controlled by one man, Snogo have cleaned snow from 11,800 ft. of runway averaging 100 ft. in width and 6 inches deep in 8 hours. Think what that means in maintaining schedules.

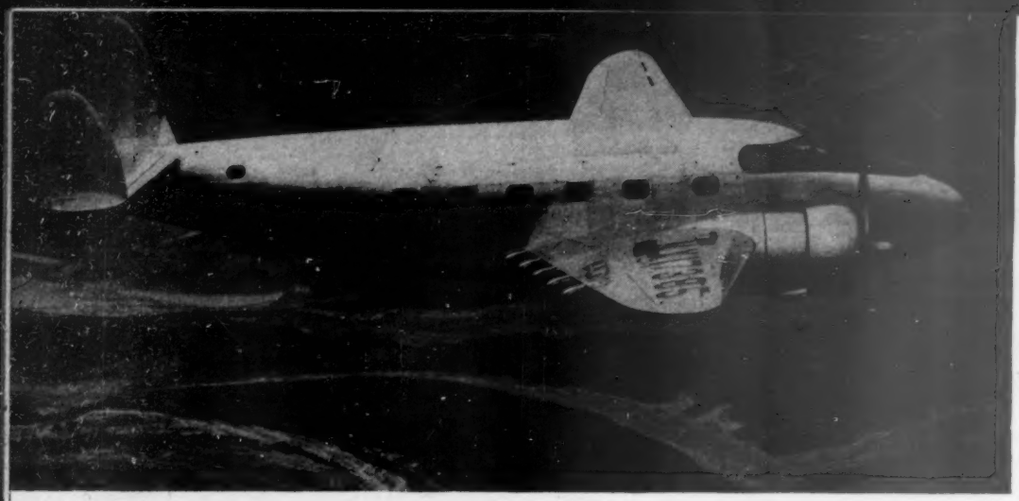
The low cost of Snogo equipment leaves no excuse for any airport being without Snogo protection. Prices and details will surprise you.

KLAUER MANUFACTURING COMPANY, *Dubuque, Iowa*

There is a Snogo for every budget. **Here and at the right below are shown the Models LMU and LTR. Two models designed and priced with airport service in mind.**

SNOGO





LOCKHEED "Lodestar"

New model "18" is added to the family of Lockheed transports now in service.

CONTINUING to carry the torch for American commercial aviation in the midst of a war-mongering world, Lockheed Aircraft Corporation conducted first flights late in September of a new airliner designed to meet latest requirements for high performance equipment of the medium capacity twin-engine class. Known as the Lockheed Lodestar, the new plane was given its initial hop by Marshall Headle, chief pilot for the Lockheed company. Flight tests were reported satisfactory and full production is planned immediately despite the heavy backlog of military business. Performance data so far available include only the preliminary engineering figures calling for a top speed of 236 mph. The new plane weighs 17,500 lbs. loaded and will cruise nonstop a distance of 1150 miles at a speed of 220 mph. The ceiling of the plane is 24,600 ft. and the landing speed is 65 miles per hour.

The wings incorporate the new Fowler flaps and the nose is of standard Lockheed design

According to figures released by the Lockheed Corporation, the Lodestar will carry fourteen passengers and a crew of three, including pilot, co-pilot and stewardess. Wing span is 65 ft. 6 in., overall length 49 ft. 9⅞ in., and general design closely follows Lockheed practice. Of typical skin-stressed all-metal structure, the Lodestar is a cantilever semi-low wing monoplane with a twin-rudder tail and conventional retractable landing gear. The time tried Fowler-type flaps and built-in leading edge slots are incorporated in the design.

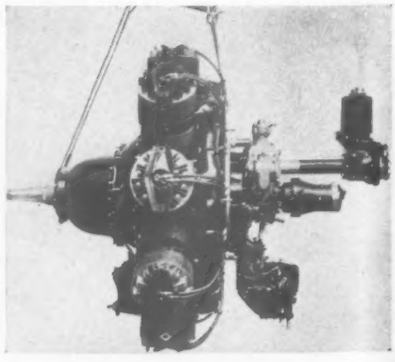
Lockheed reported that the plane had been designed to meet the requirements of a majority of air transport operators in North and South America, as determined in a recent survey. Special emphasis has been placed on provision of ample passenger facilities. Head-room in the cabin is 6 ft. 3 in., and the cabin is 24 ft. 6 in. long by 5 ft. 5½ in. wide, fully insulated, sound-proofed, and ventilated.

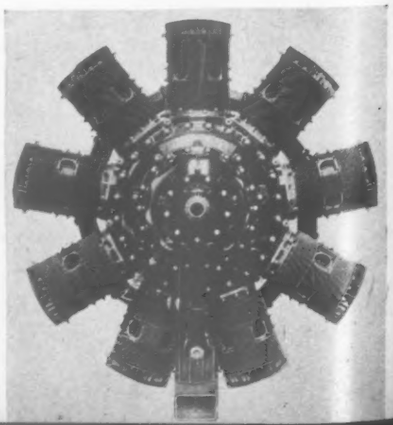
Power for the planes is supplied by two Pratt & Whitney radial air-cooled engines which develop 850 horsepower each for take-off. With this power the take-off run is only 760 feet which requires 16 seconds. Equipped with Hamilton Standard Hydromatic propellers gives the Lodestar a rate of climb of 1320 feet per minute.

Sleeve Valve Engine

Bristol Producing Engines From 600-1400 h.p.

TWELVE years of constant development by the Bristol Aeroplane Company has brought the Bristol mono-sleeve radial engine along to a point where power units of approximately 1400 h.p. are in service, and a series of four models of Bristol sleeve valve engines of single and double-row type covers the power range from 600 to 1400 hp. Features of the Bristol engines are their relatively low diameter, and the use of an accessory gear box mounted on the bulkhead and driven from the engine by an extension shaft, and by their relatively high rpm, the maximum power figures being quoted at speeds of from 2650 to 3225 rpm. The four models now listed for the trade are the Hercules, Taurus, Perseus, and Aquila with outputs respectively of 1,100, 860, 715, and 450 international rated h.p. Arrangement of the above listed engines is fourteen-cylinder double-row for the Hercules and Taurus, and nine-cylinder single row for the Perseus and Aquila. All of these engines are fitted with reduction-gear drives to the propeller shaft, and are supercharged to power ratings of from 5,000 to 14,000 ft. altitude.

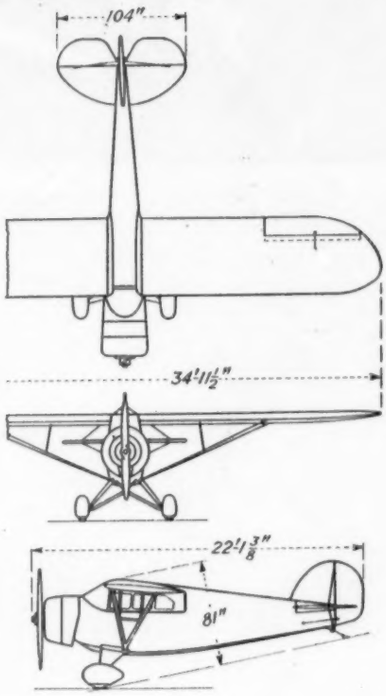




Flying Equipment

REARWIN Sportster

Model 9000KR



INCORPORATION of a new windshield design and a full N.A.C.A. cowling has given the new Rearwin Sportster an added speed of five miles per hour over its predecessors in the Sportster line. This is one of the best examples of what can be done by using the results of the current experiments in light plane engine cowling design. Along with the increased speed also comes an increase in range, fuel consumption and engine cooling adding their parts to the improved performance of the new plane.

The design of the new cowling is such that it is flush with the fuselage contour with the only exit for the air being a small opening on the underside of the fuselage in the vicinity of the firewall. The cowling sides may be raised in automobile fashion for ease of maintenance and the cowling ring is readily removable through bolts located around the periphery of the ring. Full pressure baffling is employed inside which distributes the air evenly about the cylinders of the Ken Royce 90 h.p. Model 5F engine.

The new windshield is formed from a single piece of plastic increasing the visibility over the old style Sportster by eliminating the dividing braces. Inside, the cabin width has been increased by three inches and finished with automobile upholstering. The instrument panel has been revised into a verticle panel, the entire surface of which is free for mounting instruments.

With a class 2S rating the new Sportster is designed for primary instruction, cross country trips and the private pilot. The performance figures are given as:

Maximum Speed	125 m.p.h.
Cruising Speed	115 m.p.h.
Landing Speed	38 m.p.h.
Rate of Climb	1000 ft./min.
Cruising range	500 miles
Service Ceiling	15,000 ft.
Gross Weight	1460 lb.
Weight Empty	830 lb.

TAILORCRAFT Trainer

Taylorcraft Aviation Corporation announced its new Trainer model at $1495 designed primarily for instruction. The performance and design is not different from the standard Taylorcraft. Changes come in the horsepower that is limited to 50 hp. only, and interior finishing that is made for hard wear. The engine cowl is of the open type and the dual controls can be had in any combination of wheel and stick control.

AT LOW COST

A proving ground for FWD snow removal equipment — the Municipal Airport at Clintonville where scientific testing of all practical methods of snow removal is carried on under actual operating conditions each winter.

FWD is First Choice For Fast Snow Removal

Efficient snow removal depends on the effective power behind the snowplow — FWD trucks are expressly designed with snow removal service in mind. Special gear ratios, proper snowplow mounting facilities, ample reserve power and the balanced traction of four driving wheels distinguish the FWD from ordinary trucks on snow removal jobs... These powerful FWD trucks have taken a leading place ever since motive power was first applied to the problem of snow removal. More than 8600 FWD trucks will be found in action this winter, clearing snow blocked highways, airports, and other locations... On all kinds of airport duties — for year round maintenance work — FWD trucks are preferred for their advantages in speed, low-cost operation, the powerful traction of four driving wheels. Equipped with a special grader attachment the FWD will keep gravel runways in perfect condition. FWD dependability is vital for unfailing crash and repair service — their speed with safety is needed for refueling duties as well as maintenance work at distant emergency landing fields.

Many of America's leading airports find FWD trucks to be indispensable equipment — equipment that is never idle and yielding a big return with a minimum investment. Write for complete information.

THE FOUR WHEEL DRIVE AUTO COMPANY, Clintonville, Wis., Canadian Factory: Kitchener, Ont.

The world's oldest and largest manufacturer of four-wheel-drive trucks — 30 years experience in snow removal.

WAYS *All Winter*

Gravel runways are kept in perfect condition with FWD's underbody grader — operates 50% faster than a power patrol — reduces maintenance work ⅓ under ordinary methods. This same truck is expressly designed for snow removal service.

Small airports find that one FWD unit handles the complete maintenance problem. Equipped with bulldozers and dig and carry earth movers, FWD trucks, single-handed, have built complete airports. An FWD answers every need — from general hauling to snow removal.

FWD specializes in building automotive equipment for airport service. The FWD organization has acquired invaluable experience during more than thirty years of building FWD trucks for snow removal service, together with the fitting of over 62 different makes of snowplows to such trucks. New developments and methods for airport maintenance are scientifically tested for their practicability under actual operating conditions.

Cost data and operating records on airport snow removal service, are available and will be gladly sent to you on request.

FWD trucks are built in sizes ranging from 1½ to 25 tons capacity in both four-wheel and six-wheel-drive, with engines from 85 to 200 horsepower, gasoline or diesel powered. Special gear ratios for rotary snow operation are incorporated into the standard FWD truck producing a gear ratio from 200 to 600 to 1 in low range and with road speeds of from 45 to 75 miles per hour for high-speed operation.

Sales and service facilities are available from coast to coast and in all principal countries overseas. Expert snow removal technicians will gladly submit recommendations for size FWD and most practical snowplow for your airport. Write or wire for complete information.

FWD

4,000,000 New Customers?

(*Continued from page 19*)

The word "beam" appears to have a peculiar ring of familiarity, although comparatively few seem to understand its nature and true purpose. Many appear in a class with one who expressed the fear that locating the beam must prove a tremendous strain on the eyesight. The hourly Link Trainer demonstration goes far toward correcting this confusion. Dense crowds encircle a large 150 square foot map at the rear of the Link Trainer. Upon this map flight problems are unravelled before their view. The crowds invariably remain throughout each entire thirty minute problem, a remarkable example of the depth of public interest in flying's technical side.

The Link Trainer is but one of the many interesting functional displays that go to make up the passenger transportation section of the exhibit. Separate airway traffic control, meteorology, flight control, ground to plane radio equipment and pilot's cabin displays and lectures all bear upon safety in flight. Day and night plane accommodations demonstrated and discussed by an airline hostess, and a display of hundreds of comfort items bespeak passenger comfort facilities. Engine overhaul, propellor overhaul and instrument testing stands tell the story of mechanical dependability. An interesting display of medical testing equipment emphasizes the high standards of pilots' physical requirements. In the center of the passenger section is located a consolidated ticket stand at which transportation may be purchased or reserved to all parts of the world now open to air passenger traffic. Back of the ticket counter looms the huge Curtiss-Wright 36 passenger transport completing an exhibit of practically all that enters into modern passenger flight service.

So IT IS that hundreds and hundreds of thousands have learned for the first time of the care and attention that goes before and along with each passenger flight. They have observed the careful inspection and the frequent tearing down and overhaul of engines, propellors and instruments, the checking and double-checking in preparing an airliner for flight. They have watched a meteorologist compile his weather data that forecasts flight conditions throughout a projected trip. They have been told the background of training, the strict physical and other qualifications and responsibilities of the pilot and his crew. They have been carried through the routine of obtaining flight authority and understand that while such authority may come only from the dispatcher, the pilot still may exercise his right of trip cancellation in case of any uncertainty. They have seen and heard how Civil Aeronautics Authority establishes and polices their lane of travel once they are in flight.

Finally they have thoroughly inspected a huge, fully-furnished and ready-to-go passenger airliner, from tail piece to pilot's cabin and have even had the controls pointed out and explained. They have been shown the thousand and one items and services that go aboard to assure continued comfort and pleasure enroute. They leave with nothing untried but the actual take-off, and it is reasonable to imagine that many will soon experience that step prompted by what they have already learned. First time flight sales make up well over half of the total ticket purchases made at the building's consolidated ticket sales counter.

IF MUCH OF THIS STORY has been given over to the subject of passenger transportation it is because this section of the exhibit seems to attract widest public attention. Next in popular interest are the fighting and private flying ships, both those on the floor and those suspended from the ceiling where two Army and two Navy planes alternate in arrested military flight formation.

There are two powerful fighting ships of late design on the floor and open to inspection. Two light private flying planes within the building, another outside, also invite close examination by thousands. Youngsters and some not so young have edged in and out of one of these private ships to the tune of three successively replaced new sets of seat cushions. The fact that this light plane manufacturer has set up his exhibit in such a way as to invite visitors to sit down in the pilot's seat is an excellent indication of the increasing merchandising-mindedness that is being shown by the private airplane industry.

Supporting these displays of wider general interest are the hundreds of individual pieces of mechanical and technical equipment arranged throughout the exhibit. Engines are represented in a range extending from the most powerful recent designs down to smaller private flying units. Instruments and accessories are present in profusion and include the latest types of automatic controls and other flying aids. Thus are provided many subjects of absorbing interest both to the layman and to those who are aviation-wise. A large assortment of Army and Navy airplane models supply added attraction for the younger element.

A GENERAL OBSERVATION is that fear is the greatest hindrance to a more rapid spread of flying popularity. Fear of accident, fear of the unknown, fear of bugaboos such as the odd suspicion that mountains and high hills exert a magnetic influence upon all-metal planes, drawing them into contact and consequent disaster. While many of the fears are nameless, and therefore more difficult to combat, all spring from an unfamiliarity with the medium. In view of the current trend toward war hysteria and sensationalism in the daily news and the more popular forms of public entertainment, these fears can be dispelled only by patience, careful explanation, personal contact and experience.

The U. S. Aviation Exhibit has accomplished much toward this end. It is true that many people may depart still skeptical. But others often tell us that we have given them a new point of view. Some insist that they will fly at the next opportunity. A few prove the case by buying first flight passage at the building's ticket counter. So it is obvious that the exhibit is fulfilling its intended purpose, possibly with even more success than we now anticipate.

As long as the public is allowed to nurse its fears and suspicions unchallenged, aviation cannot possibly take the important place in the sun to which it is entitled. Therefore in making a definite assault upon widespread ignorance and mistrust, the U. S. Aviation Exhibit at the World's Fair is performing a valuable and necessary service in the development of aviation in all its branches.

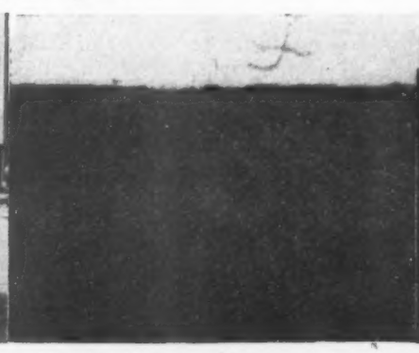
New York City's **NORTH BEACH AIRPORT**

has used 3,000,000 gallons of TEXACO Asphalt for runways, taxiways, parking area and other surfaces

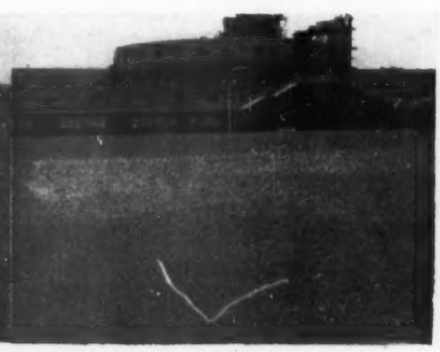
Photo by Fairchild Aerial Surveys, Inc., N. Y. C.

At North Beach, New York City is constructing a great, modern airport terminal, with accommodations for both land and sea planes. For the 1,250,000 square yards of runways, taxiways, parking area and other surfaces of this outstanding field, an Asphalt Macadam surface (penetration type) was selected. In every square yard of this surfacing, TEXACO Asphalt Cement has been used, requiring more than 3,000,000 gallons.

Applying TEXACO Asphalt in front of Sea Plane Hangar, North Beach Airport.



TEXACO Asphalt Macadam surface on Runway No. 1, which is 6,000 feet long and 400 feet wide.



TEXACO Asphalt Macadam apron in front of main administration building at North Beach Airport.

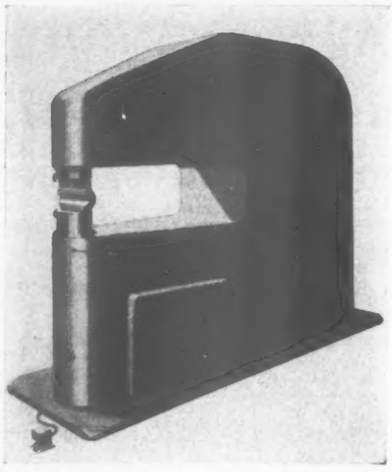
THE TEXAS COMPANY, Asphalt Sales Department, 135 E. 42nd St., New York City

Chicago Cleveland Kansas City Philadelphia Houston Jacksonville Buffalo Richmond Boston

BUYER'S LOG BOOK

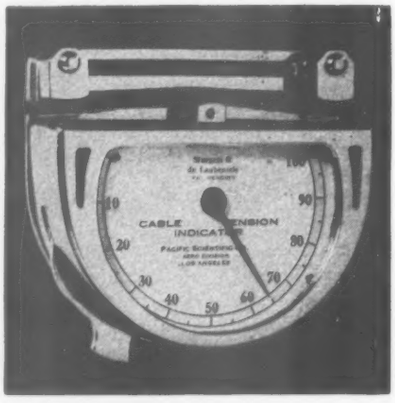
What's New in Accessories, Materials, Supplies, and Equipment

A riveter that will head in one operation, by a single stroke, from ten to sixteen flush type rivets in a straight line has been developed by the General Engineering Company of Buffalo, New York. It has been designed for use on flat sections and for operations such as attaching stiffening channels to sections of the skin. Reports have been that from 6,000 to 10,000 rivets per day have been headed by one operator plus a helper placing rivets and handling the sheets. Two flat anvils coming together do the riveting by squeezing a flat rivet of the required thickness and head size. A pressure pad consisting of two thin edged rails on either side of the anvil holds the sheets firmly together while the head is being formed. This pressure pad remains stationary after it has squeezed the sheets together and the proper head size is governed by the lower anvil.—AVIATION, *November, 1939.*



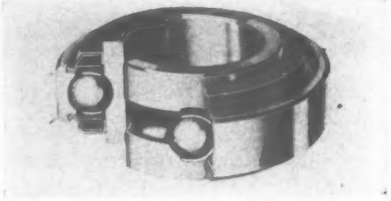
General Engineering Co. flush riveter

Designed to accurately check the rigged tension of control cables, the Sturgess & de Laubenfels aircraft cable tension indicator is offered by the Pacific Scientific Company, Los Angeles, Calif. One instrument, with a range of 30 to 200 pounds, covers the standard cable sizes from 1/16 in. to 3/16 in., or for 1/4 in. cable on special order. Weighing less than a pound, the Sturgess & de Laubenfels indicator is easy to carry and simple to use. The entire operation can be performed with one hand, and due to its small size the instrument may be inserted through small openings and otherwise used to advantage in restricted parts of an airplane structure. No temperature or other preliminary adjustments are required, it is claimed that there is no zero error, and the instrument can be used continuously without resetting or checking.—AVIATION, *November, 1939.*



Cable tension indicator

Achieving an unusually high bearing sealing efficiency without any contact material whatsoever, the "Mechani-Seal" ball bearing seal design has been perfected by The Fafnir Bearing Company, New Britain, Conn. The new seal keeps lubricant in, foreign matter out, eliminates seal friction, and is easy to assemble and disassemble. The Mechani-Seal design is an integral part of the bearing itself, consisting of two steel plate shields which form a trap, both attached to the outer bearing ring, and a third steel plate pressed on the inner ring and acting as a slinger when the ring rotates. During two years of testing under extreme conditions the Mechani-Seal design has proved thoroughly satisfactory. It is available on either the Fafnir Radial or wide inner ring bearings in single seal, double seal or seal and shield combination.—AVIATION, *November, 1939.*

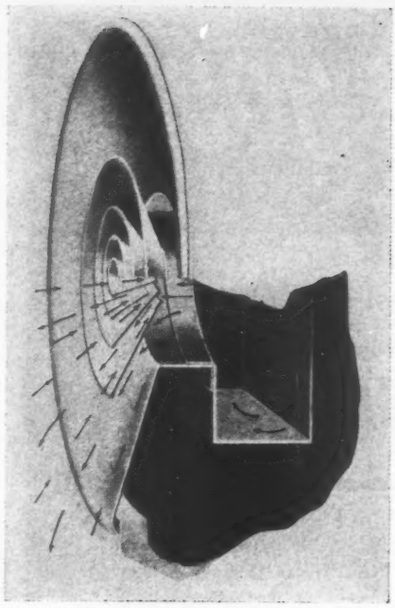


Fafnir Mechanical-Seal bearing protection

Incorporating a variable flow governor and pressure governor, a new model hydraulic selector valve, designated No. 62008, has been announced by Aircraft Accessories Corp., Glendale, Calif. Of special importance is the flow governor in controlling the volume of oil delivered to each end of the actuating cylinder for controlling the extension and retraction time of flaps. The pressure governor has two functions, both of which contribute to added safety and efficiency of the hydraulic system. First, the pressure governor adjusts the amount of fluid used for a particular operation within design requirements, by-passing the balance delivered by the pump. Second, the pressure control valve protects the hydraulic system and the flaps from loads imposed by speeds in excess of design limits. Both flow and pressure governors are an integral part of the new valve, reducing plumbing and installation problems, and eliminating separate relief valves and restrictors.—AVIATION, *November, 1939.*

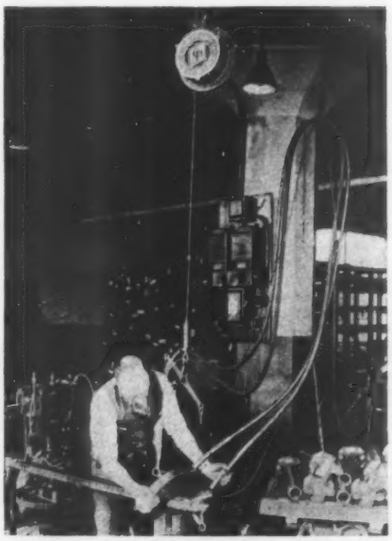
Aircraft Accessories hydraulic selector

In order to prevent passenger air sickness, it is necessary to supply the cabin with a large amount of fresh air. In order to give passengers the greatest amount of comfort, it is necessary to diffuse this air draftlessly and keep temperatures at various points equal. This tough assignment has been licked by the Anemostat Corporation of America, New York, through the development of the ANEMOSTAT. Air is brought to the diffuser through ducts located along the walls or floor or ceiling of the plane. Once inside the diffuser it travels out through the vanes in the manner shown by the arrows on the



Anemostat Diffuser

Warren McArthur Aircraft Furniture



C-P Super Safety Tool Balancer

diagram. Through the use of various aerodynamic principles some air is drawn in while other air is traveling out. This effect enables air to be carried in the ducts at engine temperature and yet to enter the cabin at normal room temperature and increased ventilation is given.—AVIATION, *November, 1939.*

One of the most reliable measures of aviation progress is the attention paid to cabin upholstery and furniture. Where our worries used to revolve around wing design, stability, streamlining, etc., they now tend to concern the location of cabin ventilators, reading lights, ash trays and magazine racks. Some of the most advanced work in design of cabin furniture has been done by the Warren McArthur Corporation, New York City. Recent Warren McArthur aircraft chairs include reclining chairs, full swivelling chairs, and just plain ordinary cabin chairs, but they all share the common merits of strength, comfort, light weight, and appearance of sturdiness and even of bulkiness, which tends to reassure the heavy-weight passengers, especially if this is their first time up.—AVIATION, *November, 1939.*

For use wherever heavy tools must be repeatedly lifted or balanced in production work, the super safety balancer has been developed by the Chicago Pneumatic Tool Company, Chicago, Ill. This tool is essentially a cable-drum-spring combination by which any tool weighing from 5 to 200 lbs. can be balanced for easy handling around the work by the operator. Travel permitted by the cable is approximately 7 ft., and distance between the two hooks of the tool-support arm is 20 in. Safety features are incorporated which protect the operator in event of failure of the balancing spring, locking the overhead drum on which the cable is wound.—AVIATION, *November, 1939.*

Doubling the production of oxy-acetylene flame cutting machines such as are used in various aircraft plants for reproducing intricate sheet steel parts, is accomplished in a new machine by using two cutting torches mounted in tandem, controlled as before from a master template on the tracing table. The new tool was demonstrated for the first time in Chicago, at the 20th annual meeting of the American Welding Society.—AVIATION, *November, 1939.*

Based on the same principles which have brought adoption of the Librascope balance computer on many of the world's leading airlines, a new Librascope instrument for power computing has been developed and placed on the market. Operating through a foolproof system of mechanical levers, the Librascope power computer enters the machine with five factors; engine rpm, manifold pressure, fuel-air ratio, operating altitude and carburetor temperature. Upon setting these factors on their respective dials the operator is able to read directly the brake horsepower, fuel consumption, and brake mean effective pressure. Developed by Librascope, Inc., Glendale, Calif., the Librascope power computer is now in production and immediately available for standard aircraft engines.—AVIATION, *November, 1939.*

Ex-Cello-O Is Ready—A handsome wire-bound 36-page book dealing with Ex-Cell-O machines used in the aircraft and aircraft engine industry. Ex-Cell-O Corporation, Detroit, Mich.—AVIATION, *November, 1939.*

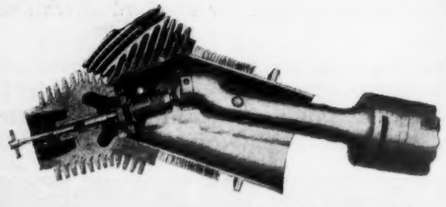
Harry C. Boardman watches demonstration of new cutting machine

"HUNDREDS of FLIGHT HOURS

with Highest Motor Efficiency —
due largely to our precision

SIOUX VALVE TOOLS"

That's the report made by Mr. Ben Follet, operations manager of E. W. Wiggins Airways, Inc., who own and operate 52 planes from four bases in New England, in addition to seaplane operations from two bases and a school with 108 active students. The picture shows one of the mechanics in their shop using the Sioux Dual Action Aircraft Valve Seat Grinder, also a Sioux Aircraft Valve Seat Grinder Set and a Sioux Valve Face Grinding Machine Wet Grinder.



SIOUX AIRCRAFT VALVE SEAT GRINDER

DUAL ACTION

The handy, dependable tool for refacing aircraft motor valve seats with precision accuracy and speed, can be used on cast, hardened steel, bronze and Stellite valve seats.

SIOUX WET GRINDER

VALVE FACE GRINDING MACHINE

For precision work in fast time,— for smoother, more finished jobs, this machine meets all the requirements of many aviation shops.

It wet grinds all valves, any angle, including 90 flat valves. Grinding head easily adjusted for large or small valves. It wet grinds valve tappets and rocker arms to original efficiency.

SIOUX No. 662 Valve Face Grinding Machine WET GRINDER comes complete with diamond dresser, micrometer gauge head and rocker arm grinding attachments, 4-quart coolant tank, ½ H.P. motor. Chucking capacity ¼" to ⅝".

Write for full information

STANDARD THE WORLD OVER

ALBERTSON & CO. INC. SIOUX CITY, IOWA, U.S.A.

THE AVIATION NEWS

REVIEW, COMMENT, FORECAST

BLAINE STUBBLEFIELD
Washington
C. F. McReynolds, Pacific Coast
Jay P. AuWerter, New York
E. R. Lockin, New York

NOVEMBER 1939

Plant Expansion?—That's The Question

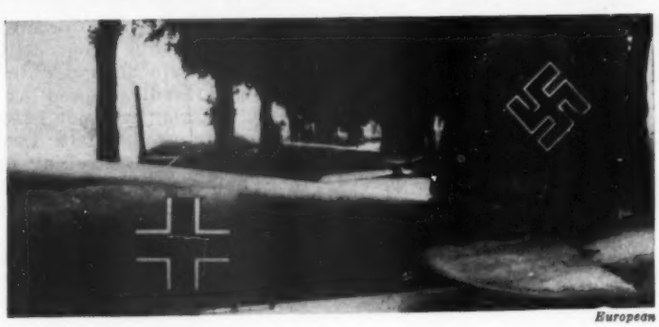
(Story on page 55)

International

PANAMA DEFENSE (top): When airplanes and U-boats start chasing ships around, the Panama Canal defenses become more important than ever. The Air Corps recently sent these B-18's to bolster the Zone's bombardment units.

EMBARGO-BOUND (above): With embargo repeal awaiting congressional action, all available hangar space in the U. S. is becoming a warehouse for stranded planes. These Lockheeds for England are being held at the Hexhangar at the Alhambra, California, airport.

INTO THE SHADOWS (right): Reversing England's procedure of getting planes out of "shadow" plants, Germany plants her planes in the shadows to avoid enemy observation.



European

NATIONAL AVIATION

How Neutrality Stands—Changes Expected

Few people are neutral about "neutrality." They all want to see Hitler trounced but they want a couple of other guys to do it. The country seems divided on repeal of the arms embargo, but Congress, as this writing went to press, was preponderantly in favor of lifting the munitions ban. When you say "munitions" in this controversy, you think of airplanes, which the Allies need most.

This is how the neutrality law stands. No kind of weapons may be exported to belligerents —in *any*body's ships. The embargo on other war supplies to belligerents expired last summer, so anybody can buy them and haul them off in his own ship or in ours. The Johnson law, forbidding credit to delinquent debtors, is still on and will stay on just now. So those who owe us have to pay cash or meet regular 90-day open accounts.

This is what the new bill says. Any country, neutral or belligerent, can buy anything in the United States: buttons, bombs, planes or poison. But they have to haul it away in other than American flag ships. Our ships, no matter what their cargo or for whom, have to stay out of belligerent waters and danger zones. Americans have to stay off belligerent ships. It is not yet clear what kind of credit arrangements will be made for the Allies, but most observers think a way will be found to let them have tick when they run out of securities and gold.

The ban on American ships carrying munitions to the Allies would stimulate the flying of bombers and perhaps light planes direct to Europe. This mass migration of ships in the air may throw a strong light on the question whether this hemisphere is liable to airplane attack from abroad.

You would expect that this earth-shaking neutrality issue would bring a new high in lobbying on Capitol Hill. It would be naive to say the Pressure Boys are not there. But they are few and furtive, because public opinion has put special interest operations in the category of high treason. One firm of airplane builders, to their eternal glory, has offered advice to Congress only when asked for it, and even then has refused to take a stand on embargo repeal.

Revising Airworthiness

At a two-day meeting in Washington, mid-October, attended by about 110 people, the Aeronautical Chamber of Commerce and the Civil Aeronautics Authority discussed recommendations for revision of civil air regulations affecting manufacturers. The proposals were prepared jointly by the CAA and the Chamber. Army, Navy, Bureau of Standards, the Safety Board, airline operators, airline pilots and other interested parties sat in. The Commercial Engineers Committee of the Chamber submitted its recommendations on behalf and in the interest of 30 manufacturers of light and heavy commercial equipment.

The discussion was divided among four sub-committees appointed by the manufacturers at an initial meeting: (1) Flight, (2) External loads, (3) Power plant, (4) General and Administrative. The 30-page recommendation was written under approximately the same headings.

In general the meeting went off smoothly with a minimum of wasted conversation. This was particularly so in the external loads committee, presided over by Ryder of the aircraft air worthiness section for the CAA and Shanley of Lockheed for the manufacturers.

Nearly all interests involved said they hoped that revision would be accomplished in pieces rather than in a job lot. Too much sudden change would cause serious dislocations. There will be more meetings from time to time.

One subject that occupied much time was the proposition that landing speed be eliminated as a criterion of safety. CAA wants it completely removed as such, while the manufacturers, somewhat more conservative, would maintain an upper limit. Removing landing speed as a safety criterion will not reduce safety, the groups felt. Other limitations such as rolling distance and obstacle-clearing ability will be introduced to accomplish even greater safety.

The manufacturers recommended that the use of take-off power be increased to five minutes. Some authorities feel that the Air Safety Board cannot prove accidents chargeable to the use of take off power; most failures result from the cruising conditions, they said.

Latest on Pilot Training

CAA is having tail flutter in its college training section. There have been reports of dissension between bosses and straw bosses.

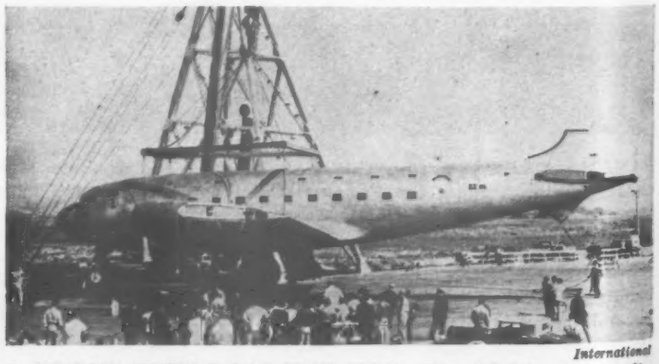
Curbstone talk, perhaps groundlessly, has the War Department in line to take over the civil training program. While many observers insist that the Army is not greatly interested in pilots trained behind low horsepower, others contend that Army is definitely interested in them as a source of cadet material free of the usual high attrition rate.

But the college flying project has set up a marvelous safety record which, if it can be maintained, will stand CAA in good stead against any row that may come, or as argument for expansion. The experimental group of 330 students flew a million miles with one fatality, which is about twice as safe as the 1937 non-scheduled record. CAA figures there will be 40,000 licensed pilots by June, 1940, probably more than in any other country. That, after all, will be something to talk about!

In the last war the Army barely had time to take down the names of its 22,000 flying cadets, give them the spinning barber chair, and make them say "Ah." Now, with the Civil Aeronautics Authority rounding up another generation of airmen, the Air Corps sees a better opportunity to find out what makes people behave the way they do while in motion in three dimensions—or why some of them misbehave. So, with the approval of the National Advisory Committee, CAA has set off about $100,000 of its civil pilot training program to study the mental and physical characteristics of the students with relation to flying.

Dean R. Brimhall comes to Washington as assistant to Chairman Robert H. Hinckley,

AIR SAFETY BOARD TAKES WINGS: In front of the two new Stinson "105's" stand Allen P. Bourdon, of the Safety Board, and Frank Miller, Chief of the Bureau of Information and Statistics of the Safety Board. By now the planes should have many hours of service, one on the east coast and one on the west.



International

A JIG-SAW PUZZLE FOR THE JAPS: The DC-4 is now on its way to Japan. Lack of 100 yard wide boats necessitated a slight dismantling job that ought to be fun to watch being put back together.

assigned to carry out the pilot research job. Hinckley was criticised for passing a plum to an old WPA pal of his, but investigation shows Brimhall to be a competent person, and anyway most executives hire somebody they know. A committee of prominent psychologists will be appointed to advise CAA in the work, which will be conducted mostly in the laboratories of the various schools in the program. The long-range objective is to enable the Air Corps and aviation schools to select from available men a larger percentage of students who can make the grade and be better pilots when they are graduated.

The Airport System

CAA will lay siege to Capitol Hill during next session of Congress for authority and money to expand the national airport system. The Authority was criticized last session for playing 'possum on this question, but it had two pretty good reasons. One was that Congress was having a fit of "economy" blues. That's all over now; you hear nothing about that silly old economy stuff. Another was that CAA was pretty much in the Congressional dog house.

If the Authority doesn't get back in same doghouse, it can go places with a demand for airport subsidy. The main theme will be national defense of thee I sing. The Air Corps doesn't really care much, but will string along. The American Municipal Association and the Mayor's lobby will point out, this time more urgently, that some 25 or 30 stations on the grandfather route system are being passed up for lack of adequate ground facilities. Best judges of this matter say there is little doubt Congress will grant at least the minimum recommendation of CAA, which was $125,000,000. On the other hand, they do not believe that the cities and towns can get together well enough to cadge a half billion or so.

Canada Becomes Supplier

Wise cracks that the British ought to sink their island and move to Canada appear not so far wrong. What looks like a fairly reliable report says that the British War Supplies Commission and United States industrial concerns, including General Motors and Consolidated Aircraft, are planning to spend $3,000,000,000 creating in the Dominion any industrial empire which would supply the Allies' long-range war needs. According to reported discussion, the British government and American industry would share in both control and financing. Aircraft production would be the first objective, then metallurgy, shell casings, aircraft instruments, small arms, parts. The U. S. War Department will discourage the transplanting of our aircraft industry beyond the border, especially if airplane and engine design go with it. But the government cannot prevent the investment of American capital in Dominion aircraft enterprise.

Importance of Canada's place in Britain's defense program is confirmed also in the announcement that the government will participate in England's pilot training program along with the United Kingdom, Australia and New Zealand. Missions were on their way from Britain to Canada to start action.

Meanwhile the Canadian Department of Transport announced that in the first seven months of this year $1,500,000 had been awarded for improvement of civil airways and airports.

Foreign Air Rates

After completing an investigation as to the extent, if any, to which the Government should further regulate the rates of American air carriers engaged in foreign transportation, the Civil Aeronautics Authority recommends that the Act be amended only to give the Authority power to require the filing of all agreements "entered into by a foreign air carrier with another foreign air carrier or with any air carrier or other carrier engaged in commerce of or with the United States." The report says that there appears to be no need at this time that the rates of American companies engaged in foreign service be regulated. US carriers so engaged do not want the regulation, and CAA agrees with them it might be detrimental to the public interest, since those carriers are competing with foreign transportation beyond this country's control. The Authority is vested with powers which, for the present, may be used to prevent any practices which would contravene the public interest.

A Look At Private Flying

Private flying, ridden by an inscrutable jinx these many years, appears to be getting a big break in the CAA civil pilot training program. Looks as if 3000 airplanes may be built in

(Turn to page 54)

THE WASHINGTON WINDSOCK

by BLAINE STUBBLEFIELD

To Fly U. S. Airplanes Over Sea to Allies

Transatlantic flight delivery of American-made airplanes might include pursuit ships as well as bombers. British and French are considering spotting of aircraft carriers on the course, with aerial patrols for protection near the other side. Planes would carry no guns and could fuel for long range. It is estimated fly away would save six weeks on delivery.

The Wright Airplane may come back to Washington, but not to the Smithsonian Institute. Town cryers have it that a magnificent rotunda is being drafted in the plans of the main building at Washington National Airport, and that Mr. Wright might consent to the hanging of his historic machine there. Incidentally, the D. C. airport will truly be national. Somebody wants to plant trees there from every state, a nice idea. Another suggestion is a World's Fair of the Air as an opener.

Watch what happens to Trans-Canada Air Lines with England seriously in the war. TCA refutes the report that it has been taken over by the Department of National Defense. It says the Canadian government wants it maintained as a "vital communication service." Whatever happens there might indicate what would happen to US airlines in emergency.

Cash and flyaway: with arms embargo repealed, Canuck pilots would be obliged to come here and fly American-made airplanes to Canada, because delivery would be made here and because, upon delivery, such airplanes would become belligerent ships and United States citizens would be forbidden to ride in them.

North Beach or Bust might as well have been in sky-writing as hearings proceeded on operators' application to move from Newark. The suction of New York politics was terrific. For one thing, the Little Flower had scooped deep into New Deal millions to build North Beach. But that wasn't all. The Powers on the Potomac were behind it, for New York is *one* place where the Army wants plenty of ground room for defense. Opinion is that Newark, and even a third airport, are destined for extra-schedule stops and for shuttle services.

Hail! Sunnyvale. National Advisory Committee will complete plans for the new aviation laboratory in four to six weeks, and will then break ground for the mighty tempest tunnels and buildings. Sunnyvale is South of San Francisco Bay, in the prune orchards and out of the fog. It was a Navy dirigible base and was transferred to Army when the Macon washed out. The massive hangar is full of Army airplanes, will not be used by NACA.

7000 pages of conversation have been recorded in the suit of United Air Lines against the Government for alleged damages due to the mail contracts cancellation. Another hearing was held by the Court of Claims October 23. Experts guess this case will be decided for United, but the Administration would hate to take the blame for its colossal mistake till after the elections.

Safe air plane promotion has been dormant at CAA since Gene Vidal's "$700 mistake" but it's beginning to simmer again. Introduction of fool-proof planes of the Hammond and Weick caliber into the college pilot training program is being talked as a means of practical demonstration.

calendar 1939, and of course most of them will be for private use. The kids are going for aviation all right. But the big automobile-and-boat-owner population, which has the money and could support a tremendous airplane industry if it would, is not coming across. Those opposite schools of thought on this subject are still opposing. One says private airplanes have to be fast and powerful, able to fly high and buck headwinds, or they're of no use. The other says such airplanes can go only to airports, where very few people want to go, and besides, John Public and his wife are afraid of them, and couldn't afford one anyway. This school wants a fool-proof job that can squat on and leap from the village ball park; it has to be cheap and if it hasn't much speed, why that's okay. You can sell 'em. And so it goes. Well, to the casual observer it looks like a draw between the two theories, with the "fast and powerful" school in complete control of the practical field. But a close look around Washington shows the slow and safe boys gaining ground. The National Advisory Committee seems to be, unofficially, on their side. Expect action on this problem "after the war."

In The Air

CAA inspectors don't like the traffic jams they run into getting from airport to airport in metropolitan areas; so Authority has just bought two Stinson 105's for this service. Air Safety Board gets two others. . . . Next time you're up 18,000 and can't get higher, try dropping your flaps. Capt. B. J. Jeaslee tried it on a B-18A bomber last month with astounding success. . . . Add air races: Fastest ship getting to Miami from 1,000 miles or more away pulls down $4,000 and the Macfadden Trophy, while also-rans split another $4,000. Scheduled for Jan. 5. . . . Canada spent $1,500,000 on airports and airways first seven months of '39, Commerce Department reports. . . . Moffett Trophy for safest Navy aviation unit based on a battleship or cruiser goes this year to the USS Tennessee. . . . Air Youth of America is a new Rockefeller-sponsored outfit that will aid and abet the country's 1,500,000 model airplane builders. . . . Aerial attack seems to be this year's football favorite as word comes that Louisiana's Tigers and Pittsburgh's Panthers are both using airplanes to play distant games and still have time for a little study.

DEFENSE

What's What in U. S.

While administration leaders in Congress are striving to confine business of the extra session to neutrality, military and naval committee members are keeping in close touch with departmental officials in preparation for whatever additional national defense legislation may develop. Rumors of further augmentation of the defense forces, particularly the army air corps, though not officially verified, are considered significant.

Among plans said to be under consideration are: (1) appropriations to accelerate the present defense program, for example, by telescoping aircraft purchases so as to complete the two-year program in one year; (2) advisability of increasing the army and navy to full authorized peace time strength and authorizing additional airplanes for the army; (3) revision of army procurement legislation in line with the War Department's desire to facilitate material purchases, and (4) enlargement of the strategic and critical materials program.

Appropriations covering expansion of the forces under the President's executive order are thought the least that may be granted if the session is thrown open to general business. Hearings on regular army and navy appropriations bills are expected to begin in December at the latest.

Defense Advance

Meanwhile, the present defense programs moved forward with these major developments:

The army took another step toward centralizing command of the air corps by transferring Brig. Gen. George H. Brett, chief of the air corps material division from Wright Field to Washington headquarters to simplify procurement problems.

Biggest award for army planes went to Glenn L. Martin Co.—$16,125,586 for type B-26 bombers. In this connection, the Martin company arranged introduction of bills in both houses to complete the Baltimore airport, for the stated purpose of enlarging facilities for testing planes for the army.

Recently the War Department went on the air to boost applications for its pilot training program. It is understood that it is becoming increasingly difficult to keep admittance standards high and still add enough new students every 6 weeks. To provide additional ordnance officers for the air corps, a new six-months course in aviation ordnance was recently begun at Aberdeen Proving Grounds.

Press reports from overseas of the performance of Curtiss pursuit planes used by the French as "one of the sensations of the war" has elicited unofficial announcement that later models, presumably the Curtiss P-40s under construction for the army, are capable of a speed "at least 50 miles an hour in excess." The French planes were previously described as able to surpass 300 miles an hour.

In the naval air base program, bids will open Oct. 18 for work at the new Jacksonville base. Meanwhile, local interests are seeking to develop the northeastern base at Quonset Point, R. I.; bills were filed to provide $25,000,000 to begin building.

Airships Again

Both aircraft and airships are featured in the navy's neutrality patrol. The aircraft carrier Enterprise, with an accompaniment of 80 planes was dispatched as flagship to Pearl Harbor to form the spearhead of a strengthened Pacific Coast defense, while the navy's 6 airships were pressed into service in the Atlantic. Smaller than the navy's ill-fated giant dirigibles, these airships are said to be particularly valuable for observation purposes. From them, submarines can be sighted 100 feet below the surface under favorable conditions and they are able to hover low enough to communicate by megaphone with vessels. Sen. Morris Sheppard, chairman of the Senate Military Affairs Committee, has announced his intention of seeking early action after the January session convenes on his two bills comprising an ambitious program for Federal aid to commercial dirigible development. There are no indications, however, that the Navy is preparing to undertake construction of a larger lighter-than-air craft authorized in the "Big Navy" bill.

Following announcement by Secretary Morgenthau on September 18 that he is prepared to negotiate closing agreements under the 1938 revenue act, aircraft manufacturers contemplating plant expansions in connection with Government plane orders began sounding out Federal officials in an effort to determine what percentage of new plant construction costs may be allowed for tax deduction.

For the first time, the Treasury is authorized to make closing agreements, binding on both Treasury and contractors, which would set forth in advance of completion of contracts the maner in which the Bureau of Internal Revenue is to treat the cost of any new facilities in the computation of profits under the Vinson-Trammel Act.

Plant Expansion

Extent to which the aircraft companies may enlarge their factories to accelerate completion of Government orders is expected to be contingent on the percentage allowed. This vital question depends largely on the attitude of the War and Navy Departments, who must certify the necessity to the defence program of the contemplated plant expansions, the uselessness of the new facilities after completion of contracts and, most important, the proper portion of the cost that should be chargeable against profits.

Formerly, costs of new facilities were amortized by depreciation or obsolescence allowance.

While no formal closing agreements have yet been negotiated between the Treasury and aircraft companies, preliminary discussions are underway in certain cases. Supplementing the Navy's increased plane program, personnel studies have begun.

ONE OF THE PROPOSED NEW FLEET: With things popping across the waters the Air Corps has in mind buying a fleet of 500 bombers similar to the Flying Fortresses, only a little larger and faster than the B17's.

Home Vs. Foreign Orders

Under the new aircraft release policy the Army and Navy could authorize the export of almost any equipment, however new, to any country. In effect, outside observers say, the revised policy tends to validate the Douglas-French deal which was in controversy during last session of Congress. But though War and Navy now assume more liberty to facilitate the sale of aircraft abroad, they will protect the public interest as heretofore by withholding all developments and designs of value to national defense.

Will Hold Designs

In fact it is pointed out by some manufacturers that the release of certain equipment in production, even though of the latest design, could do little damage. Those who buy it are in no position to manufacture copies in less than a year. By that time it is a year old and meanwhile the original designers are again a year in advance of the sale. Much more damaging to the national security is the sale of laboratory developments not yet in production. This practice will be more restricted than ever.

While the new release policy seems in general to facilitate allies' purchases of American equipment, a simultaneous policy step in the opposite direction aims to insure Army and Navy of first call on the country's aircraft productive capacity. In a letter from the Aeronautical Board transmitting the new release policy, Army and Navy request all manufacturers of airplanes and aeronautical equipment "in each case when a contract is being negotiated for deliveries . . . to foreign or domestic customers other then the U. S. Government" . . . to notify the Chief of the Air Corps, War Department, or the Chief of the Bureau of Aeronautics. This is not a law; it is a request. Requests from War and Navy are usually complied with.

Some manufacturers have already objected privately to letting the Government know about their mere negotiations with foreign prospective purchasers. They say that the Air Corps, for example, seeing Company A operating at 75% of capacity and having several prospective foreign orders, might give its award to Company B, also operating at 75% but having no foreign prospects. Then later Company A's foreign prospects might fall through, leaving it without the Air Corps business it might otherwise have received.

Opinion, both official and private, however, is that the air craft industry, inasmuch as it subsists largely upon government business in the long run, must expect a certain amount of federal control. In fact that will go for even strictly commercial industry, in emergency. Further, in case of full mobilization, all industries would be subject to the duties of citizens: that is, to serve the interests of the country.

It requires no reading between the lines to conclude that the Government is encouraging plant expansion, but only to the point of adequacy for home military needs. What *degree* of expansion will be required is unpredictable. It depends upon Congressional response to the Administration's forthcoming request for additional air strength, which in turn depends upon world events. It is conceivable that the turn of events may call for heavy emphasis on *export* of equipment. You will observe that the Administration is being implemented for either eventuality.

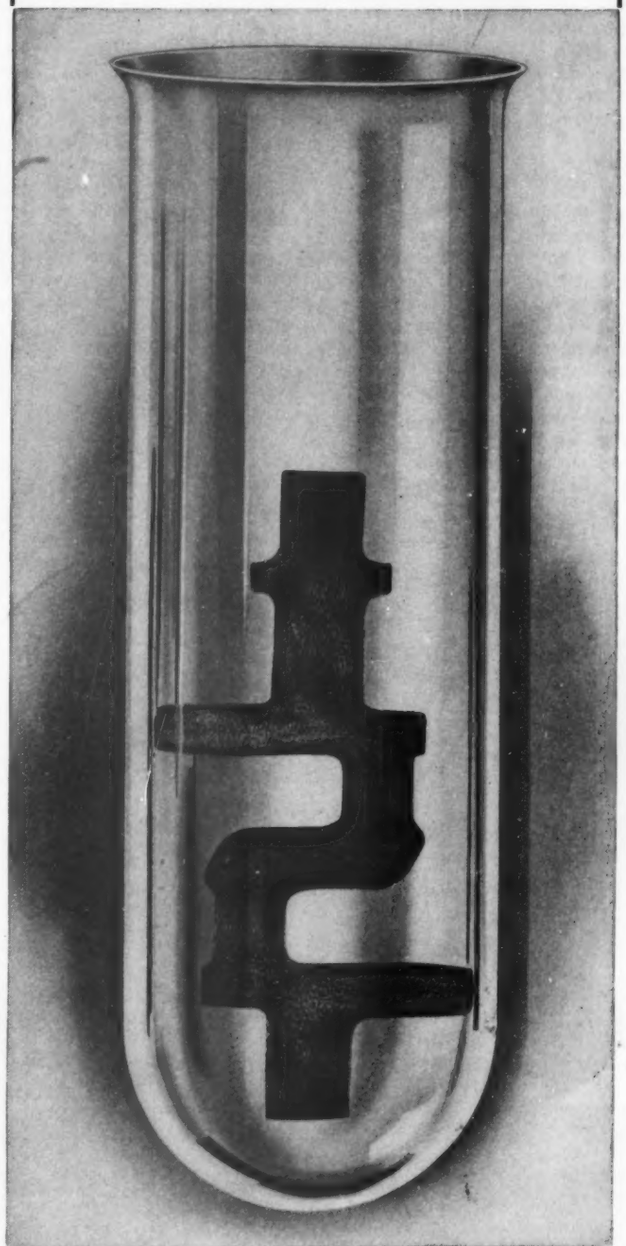
For the present War and Navy are sidestepping responsibility for inevitable deflation as a result of idle plant that will come upon cessation of hostilities. Tax allowances are in the hands of the Treasury. But the Treasury will demand an okay from Army and Navy on necessity for expansion. A very elastic subject, and so the buck will swing back and forth. It adds up to this: that unless the industry can get a deficiency guarantee from Congress it will get stuck for any expansion over and above the needs of the United States—unless it charges the cost off in prices to foreign purchasers. Of course if the Allies and neutrals can be made to pay for U. S. defense expansion, it will pass as a neat trick.

Army Navy Liaison

The Aeronautical Board, with which few are familiar, is a liaison group between Army and Navy for the coordination of their aviation arms. It is headed by the commandants of the Air Corps and the Bureau of Aeronautics; has two working officers: Major D. G. Lingle and Cmdr. A. N. Pride; has its own staff of eight engineers, four from each Service.

The release policy of the Board takes no cognizance of the granting of arms export licenses by the State Department, but is based on the Espionage Act of 1917, which provides punishment for persons who wilfully impart information to foreigners for the injury of the United States.

Laboratory Controlled



Note the Grainflow

WYMAN-GORDON

WORCESTER, MASS.

HARVEY, ILL. DETROIT, MICH.

Guaranteed Forgings

FOR *Development* DEPEND ON DOUGLAS

DOUGLAS presents today's outstanding attack bombardment airplane. Developed for co-operation between air and ground forces, it provides the full offensive and defensive effectiveness of aviation for use in the tactics of ground commanders. The result of extensive research and development, it fully expresses the long experience of Douglas in producing successful multi-engined military and commercial airplanes.

Douglas Aircraft Co., Inc., Santa Monica, Calif.

"FIRST AROUND THE WORLD"

Now the World Over

DOUGLAS

AVIATION ABROAD

Neutrality Effects Abroad

Neutrality troubles described here last month may lead to dragging out for overhaul the old question of how high up a nation's sovereignty extends. Back before 1914 there was quite a minority group of air law theorists who argued for a freedom of the air something like that on the sea, the idea being that each country should control the air over it up to a certain height above which everyone would be free to fly where and how he pleased. Nothing has been heard of this for the last twenty-five years or so, and all countries have claimed and honored the others' claims to all the air above them. However, if you are a neutral with an air force of 500 ships or so and one of your warring neighbors with 5,000 decides you would make a nice shortcut to where he's going, you aren't going to have much of an air force left if you do all you can to stop him. The small neutrals of Europe have already been put to a lot of trouble and have lost some ships trying to enforce their neutrality, and there's growing talk of the possibility of their declaring a sort of aerial three mile limit above which they won't be responsible for what happens. Just as the three mile limit was set from the effective range of old time coast defenses, this one would be fixed by the ceiling of good anti-aircraft accuracy. This would relieve the neutrals of a good part of their present responsibility at the possible cost of a steady shower of disabled planes from the No Man's Air above them. Don't be afraid that the foundations of international air law are tottering; there's not much doubt that if they do take such a step now they will reassert their authority upstairs as soon as the war is over.

Men Under 30

The end of the Civil Air Guard training scheme at the beginning of the war left the English with the question of what it was supposed to do and how well it did it still unanswered. What will become of all the CAGs hasn't been definitely decided, but those who volunteered and hadn't yet started their training have been told to enroll in some other service. Men under 30 who can meet the regular R.A.F. qualifications will probably be turned over to it for further training; the others are to be kept for ground jobs. Women CAGs, whose presence in the organization was one of the critics' favorite points, are now being turned loose for a more practical type of war work.

The clubs and schools which were loaded with hopeful CAGs are now running full blast turning out R.A.F. pilots. The Air Ministry says that after the war the scheme may be revived, but our guess is that it won't be in anything like its early form. By its shotgun nature it was a pretty inefficient way of locating good R.A.F. material, and as far as promoting private flying and building up a civilian reserve go, there are better ways of doing this than by bringing everyone who applies up to the stage where he can barely get around in the air and then stopping.

Airplanes Over Subs

The war in the air continues to run opposite to the form books; instead of beginning where the last one left off it sometimes looks as if it began where the last one began. There have been a few new angles, though. At sea the capabilities of modern flying boats have given them an outstanding part in anti-submarine warfare, not only for patrol and bombing work but even for such jobs as rescuing the crews of torpedoed vessels. As for the old airplane vs. battleship argument, you can get any answer you like according to whether you listen to those who were bombed or those who did the bombing. One feature of the war in Spain that is missing so far from this one is large scale air attacks on merchant shipping; you can probably expect it when things toughen up. There's a lot of argument on whether the convoy system for protection against submarines doesn't set them up in the bomber's alley. Over land the picture has been limited pretty much to reconnaissance and defense against it. Nothing has yet happened to justify either side in tooting about the superiority of its ships or pilots. No surprise types have appeared, but the Germans have been trying out here and there the new Messerschmitt Me. 110 two seat fighter, from which they expect great things. It has two 1100 hp. DB601 engines and a reported top speed of close to 400 mph., and was in heavy production when last heard from. Fighting has so far been limited to minor battles between small groups, and the tactics used have brought out I-told-you-sos from oldtimers who claimed all the talk of fighting in formation was bushwa and that a scrap would break down at once into individual dogfights.

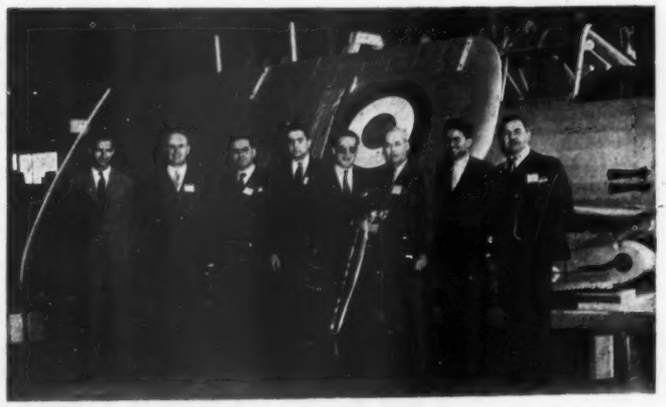
Parachutes Effective

One surprise has been the big percentage of crews saved by parachute from ships shot down. The effectiveness of anti-aircraft fire is still a question; from what evidence is at hand it seems to be doing a pretty fair job up to 20,000 feet or so in daylight with good weather. Add to Life's Little Jokes the paint job the British are now doing. After years of campaigning to get aerial markers put up over the country so that a pilot could find his way around without having to come down and look at the signs on railway stations, they are now busy painting them all out to keep the Germans from using them.

Saving the Pieces

The European airlines are now picking up the pieces of the prewar airline map, and considering the difficulties they are doing a fine job. In general the countries at war have been content to limit their lines to strategically important ones inside their own territory, while the neutrals have been trying to carry on business as usual where they can. Fares have been boosted substantially in most cases.

DOUGLAS IS HOST: With neutrality becoming an enforceable word the Dutch are casting longing eyes at American-built planes. These members of the Netherlands Royal Air Force are putting their orders in with the rest at the Douglas plant.



AFTER THE BAN IS OVER: These French delegates are patiently waiting in hopes the neutrality law will be revised to allow shipment of their order at the North American plant. One of the order seems to be waiting along with the delegation.

The British will keep up quite a net work of both internal and external lines. Just now they are thinking of reestablishing some lines to the continent. Services to India and Australia have been cut from three to two a week, and the African line from two to one. Restrictions on civil flying in England are fairly typical. A north-south line has been drawn just about down the middle of the island; everything to the east of it is a prohibited zone, while to the west civil flying can be done by special permit. Seven ports of entry have been set up near the coast for planes to enter and leave the country through narrow corridors. The two serving European traffic are Shoreham, on the coast south of London, and Perth in the north. All ships must fly by day at 1,000 to 3,000 feet.

AS OTHERS FLY IT

Germany's Aerial Westwall?

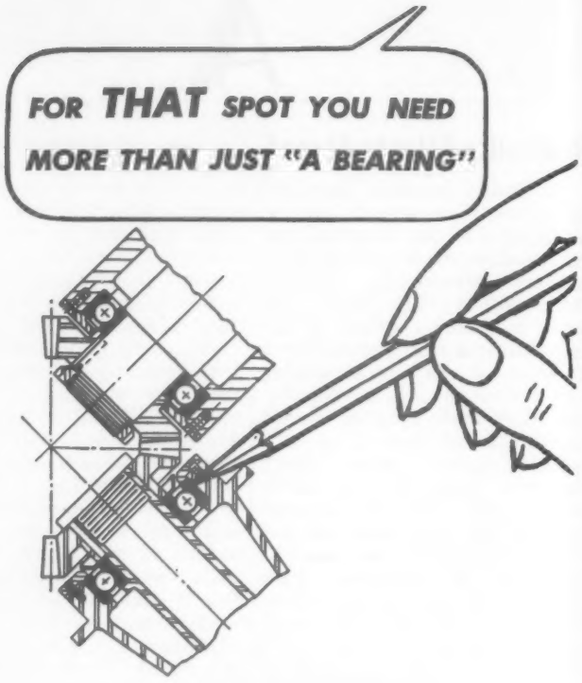
Keep your eye on the German attempt to prove (or is it for home consumption only) that an aerial Westwall can be set up that will be next to impassable for enemy ships. Instead of concentrating most of her air defense forces around probable targets, which is the system that has generally been followed, Germany is keeping hers up near the frontier in what she calls the West Air Defense Zone. If it works as well as the Germans think it will, the air strategy textbooks will have to be revised, as they all claim that defense of a frontier against air attack is so impossible that there's no use considering it seriously. The Germans have gone ahead on an elaborate permanent setup designed to prove the experts are wrong.

The backbone of the Air Defense Zone is a line of heavy antiaircraft guns (probably the 88 mm that showed up so well in Spain) running from Switzerland to the North Sea. These are supposed to be thick enough to bring five or six guns to bear on any spot up to about 20,000 feet. Combined with them are lighter guns to take care of low attacks, and the usual array of searchlights and sound detectors. Light mobile antiaircraft units are also scattered around the fairly wide stretch between the Air Defense Zone and the front. Balloon barrages are also used—the Italians report that the Germans have been working on a variation of this idea by exploding the balloons from the ground like mines instead of depending on the attackers being brought down by running into the cables.

Just how effective the zone has been so far can't be said. British and French claims that it never touched them can be taken with a couple of grains of salt. Of more importance are the official German lists of enemy ships brought down, for these include a couple knocked off a long way behind the supposedly airtight zone. Just how it can hope to be effective in thick weather is one for the Germans to answer.

Behind the heavy antiaircraft guns come fields for fighters; in this part of the zone are a number of searchlight companies specially trained in cooperation with them. Apparently the Germans have not gone in heavily for the elaborate underground hangars that have been mentioned here and there. Instead they will depend on scattering their ships over a lot of small fields, which they figure will make destroying many of them on the ground a big job.

One possible byproduct use of the Air Defense Zone that the Germans are counting on is employing the antiaircraft guns against a ground advance if one gets that far. They claim that at Bilbao in the Spanish war the heavy antiaircraft units of the Condor Legion had to double as field artillery for Franco, and turned out to be very effective due to their high rate of fire. The guns in the Air Defense Zone have been mounted and protected with this use as a backstop in mind, and this may even have had something to do with the decision to concentrate so much antiaircraft up near the front.



YOU GET MORE FROM FAFNIR!

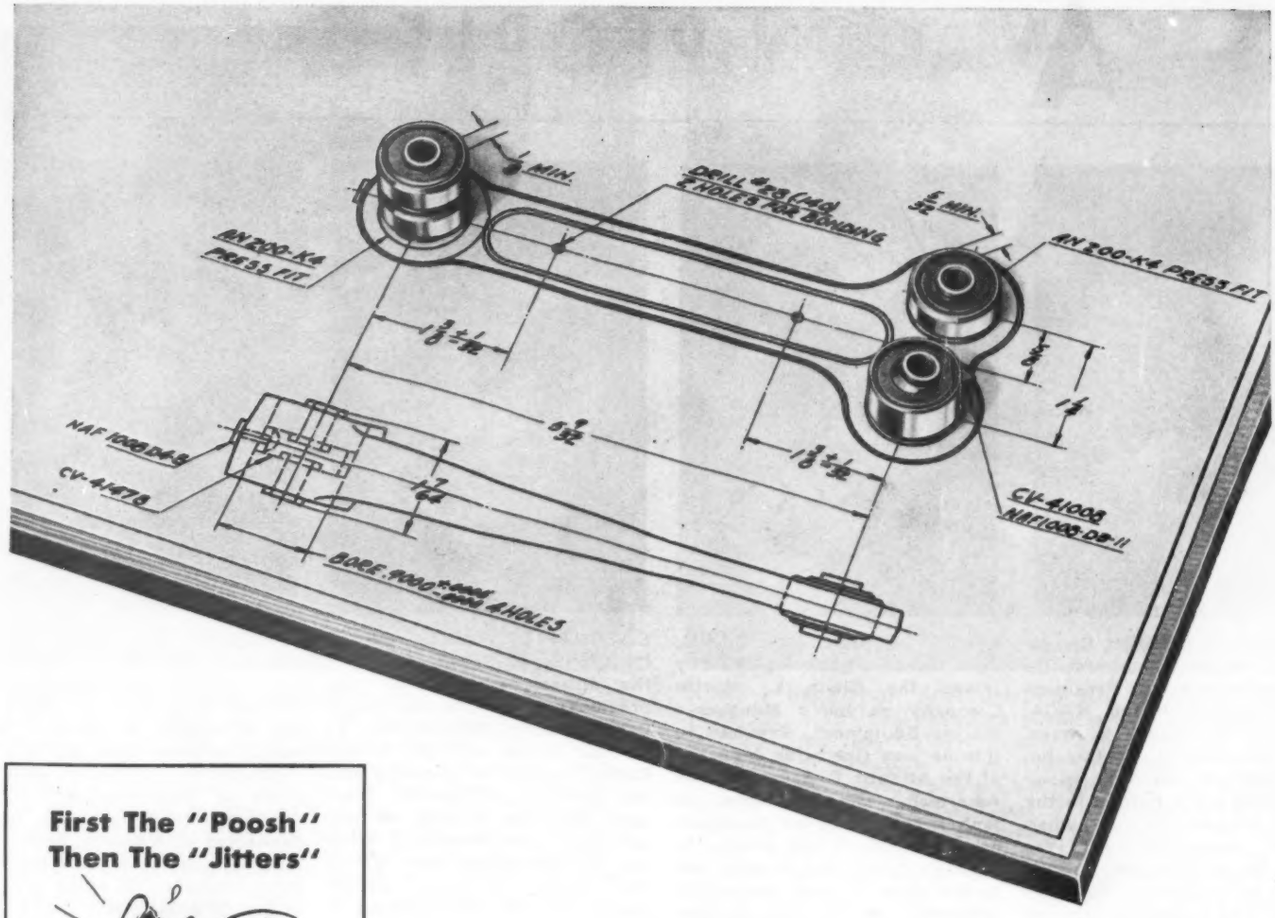
The frictionless service that a ball bearing delivers, important though that may be, is often only a part of the order that Fafnir delivers to an aircraft or engine manufacturer.

From many sources, you can get ball bearings that will reduce friction. But are they suited to aircraft service . . . to your application? If your design calls for a radical mounting, can you get engineering help? How can you get a "plus" in load capacity . . . in proper lubricant? What kind of deliveries can you get on your chosen bearings?

Frictionless performance, plus the right answers to questions like these, has proved that a bearing problem solved by the Fafnir Aircraft Division means more than a box marked for shipment. The Fafnir Bearing Company, Aircraft Division, New Britain, Connecticut.

FAFNIR

THE BALANCED LINE....



First The "Poosh" Then The "Jitters"

When push-pull rods are equipped with plain-bearing idlers, the best pilot is the guy who eats the thickest steaks – *at first.* Every idler "drags its feet" at three points – the friction is terrific! Then comes WEAR, and side-motion on each idler. A slight motion of the control is lost before it reaches the other end of the assembly, like the choo-choo trying to start the caboose!

BALL BEARINGS BEAT BICEPS ...TO CURE "EPILEPTIC IDLERS"

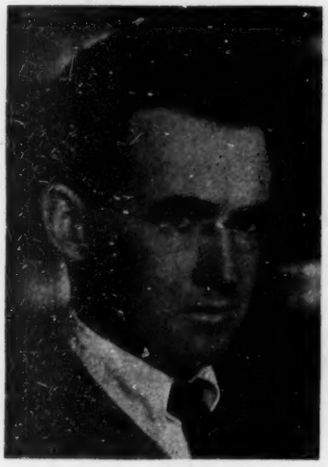
Designers took a big step ahead when they straightened out "bow-legged" push-pull rods by cutting in an idler here and there. Now, many an alert engineer is taking the important *second* step shown in the tracing above – Fafnir Ball Bearing equipped idlers, to make the long rod as sensitive to control as a fiddle-string – *and keep it that way!* Riding on two Fafnir K-4 Aircraft Bearings, the idler moves freely, but without wear at the points of support. The rod members stay slack-free, too, for each one terminates in another K-4 and a self-aligning DS-4 at the idler head. The whole assembly delivers motion accurately from one end to the other, throughout the airplane's life * * Further proof that a little engineer beats a hefty pilot when it comes to making a ship behave * * Prove it for yourself, by lettering the right Fafnirs, right on your sketches! The Fafnir Bearing Co., Aircraft Division, New Britain, Conn.

Ball Bearings

MOST COMPLETE IN AMERICA

FOR AIRCRAFT ENGINES AND CONTROLS . . .

AVIATION PEOPLE

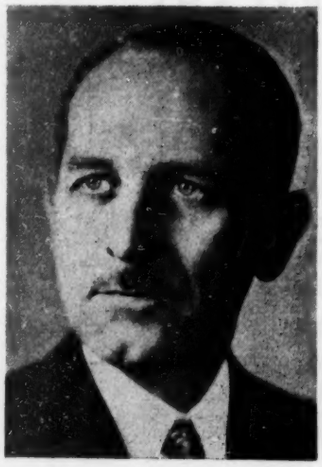


NEW NACA MEMBER: George Jackson Meade has recently been appointed by the President to membership in the NACA, succeeding Dr. Joseph S. Ames. Meade attended the Massachusetts Institute of Technology and started his activities in the aircraft industry in 1917 when he was associated with the Wright Martin Company. Until recently he was with United Aircraft as vice president, director and chief engineer.

SALES MANAGER: C. H. Schildhauer has recently joined the Glenn L. Martin Company as Sales Manager—Marine Equipment. Previous to this he was Operation Manager of the Atlantic Division for Pan American. His experience in long range ocean air transport operation should add greatly to Martin's flying boat division and to the Navy in their operations problems, as he was a commander of Navy air squadrons.

EXECUTIVE VICE PRESIDENT: B. H. Gilpin took over the duties as executive vice president of the Chandler-Evans Corporation on October 20th. To do this Gilpin left the Bendix Radio Corporation where he held the position of General Manager. Previous to this he was connected with Pratt and Whitney Aircraft where from 1929 to 1937, when he joined Bendix Radio, he held the position of Factory Manager.

PRESIDENT'S ASSISTANT: Oliver P. Branson, of Oklahoma City, has just been named to fill the new position of Assistant to the President of Braniff Airways. Branson joins the Braniff organization following several years of investment and banking experience. He has been connected with several bank and trust companies around Kansas City, however, his office will be in Braniff's Oklahoma City headquarters.



CONSULTANT: The CAA recently announced that J. Parker Van Zandt has been appointed an economic and technical consultant. Van Zandt has pioneered in the aviation field for twenty-two years. During the war he helped organize the Air Corps Engineering School at Dayton. From 1935 to 1938 he was connected with Pan American Airways in the development of their trans-Pacific operations, establishing the base at Honolulu, and later was General Representative at Manila.

CHIEF ENGINEER: E. B. Nowosielski, as head of the engineering department of the Edison-Splitdorf Corporation, one of the Thomas A. Edison Industries, has the responsibility of guiding the company's expansion into the aviation field. He is known for his development of the "double" magneto to replace the dual magneto equipment on airplanes back in 1924. In 1928 Nowosielski joined the Scintilla Magneto Company with whom he was connected for eleven years.

MANAGER: E. P. Queri, aviation department manager for the Los Angeles Chamber of Commerce, has resigned his position effective October 15, to become manager of the industrial department of the Chicago Association of Commerce. During twelve years' service with the Los Angeles Chamber, Queri has been closely identified with the successful industrial expansion program, and it was largely through his efforts that a number of Eastern plants have been moved to Southern California.

RESEARCH: John G. Lee has been appointed Assistant Director of Research in charge of the technical branch at United Aircraft. Lee has been associated with United Aircraft since 1932, when he became project engineer for the former Chance Vought Aircraft Division. Previous to that he was an instructor in aeronautics at M.I.T. which he left to join the engineering staff of the Curtiss Aeroplane and Motor Company, previous to his Vought connection.

NATIONAL AIR RESERVE CORPS MEET: Officers of the National Air Reserve Corps of the U. S. held their annual meeting in New York on October 9th through 11th. Left to right Lieut. A. H. Near, president, Capt. Edward L. Smith, president of the second corps area, and Capt. Casey Jones were three of the important members at the meeting. The convention felt that the Air Reserve Corps needed a big numerical boost and that more civilian interest should be encouraged that would give the corps a good foundation, as at present the number is below what they believe is adequate for our national defense.

A NEW DIRECTOR FOR UNITED AIR LINES: Frank W. Fuller, Jr., (left) San Francisco business executive and sportsman pilot, has recently been appointed by United Air Lines to the Board of Directors. W. A. Paterson, president of United, does the congratulating at the main offices of United in Chicago. Besides this new position Fuller is secretary of the W. P. Fuller & Company, manufacturers of paint on the Pacific Coast. He has proven his ability as a pilot many times, his latest achievement being the winning of the Bendix Trophy race for the second time at the National Air Races this past September.

PUBLIC RELATIONS: W. H. "Bob" Neff has just taken a position with Pan American Airways in the Public Relations department of the Atlantic Division. Previous to this he was New York press representative for United Air Lines. This position had followed his being aviation editor of the Wall Street Journal. Neff was succeeded as press representative for United Air Lines by Frank Buchner, who left the position of aviation editor on the Newark Ledger to take over in September.

PRESIDENT: Lyman S. Peck, who has been associated with Pan American Airways, has resigned to accept the presidency of Aviation Consultants, Inc. Peck had been with Pan American for the past eleven years. Previous to that he was vice president and general manager of Pacific Alaska Airways. He has also been general manager of New York Airways. Aviation Consultants specialize in various phases of commercial and military aviation, including development and planning of airports.

PRESIDENT: D. E. Gamble, of Chicago, has been named president of the Pump Engineering Service Corporation of Cleveland, a subsidiary of Borg-Warner Corporation. Gamble for eleven years has been vice president and general manager of the Borg & Beck Division of Chicago, manufacturers of automotive clutches. The PESCO company was acquired by Borg-Warner early this year before which time it was an independent company. He will hold his original position plus the new one.

VICE PRESIDENT: R. A. Von Hake, formerly Lockheed factory manager, was elevated to the post of vice president in charge of manufacturing. Von Hake is one of the Lockheed company's old timers, having joined the organization in 1928. He was made a chief draftsman under the late Gerard Vultee, and later became chief engineer. From that position he became factory superintendent, and finally works manager in July, 1938. He has been prominent in speeding up Lockheed's output.

AVIATION MANUFACTURING

Production Summary

Nearly drowned out by the furor over military production was a 90% increase in the number of civil aircraft for domestic sale produced during 1939's first half as compared with same period last year. Half year production, which in 1938 was only 853, this year rose to 1,627 planes.

Entire increase was in light planes weighing less than 1,300 pounds. While heavy plane production remained constant at 288, light planes more than doubled in number, increasing from 566 to 1,339. By horsepower, biggest jump was in the 50-70 hp. range, where number of planes increased from 7 to 466. Multi-engined aircraft rose 53%, from 39 to 56.

Trend to monoplanes continued, with number of biplanes dropping from 72 to 46.

From South America

While an explosion of export orders from the European belligerents hangs fire pending completion of Congressional action on neutrality, anticipated big increases in Latin American business are also held up by the credit situation. There's a good chunk of orders ready to swing from Germany and Italy, but this business has always been done on three to five year credits and something similar will have to be worked out before it can come here.

The administration is busy exploring means of providing the needed credit; Export-Import Bank just has no money available. That something will be done was made clear by Sumner Welles speech at the Panama conference and the President's announcement that he would ask Congress in January for an extra $100,000,000 for the bank. The Johnson Act forbidding credits to defaulting nations, it should be remembered, does not apply to South America.

Orders Is Orders

Airplane manufacturers are sitting on the largest backlog in history with pencils poised waiting for repeal of the arms embargo, regarded in Washington as virtually certain, to release a flood of orders that will drive production well above present capacity—forcing some plant expansion and two—or three-shift operation. As a matter of fact, report has it that belligerents are already placing large orders—a figure of 5,000 planes has been mentioned—conditional upon lifting of the embargo; aviation circles deny, however, that any foreign orders have been placed since the neutrality proclamation.

On the French and British orders previously placed production is going right ahead with deliveries being made to the purchasers' agents in this country. The French contracts provide for payment even though delivery abroad proves impossible, and it is probable the British have some similar arrangement.

Although production is now only at about 65 per cent of capacity, it is rising steadily and, on the basis of orders now in hand, will apparently be crowding capacity soon after the end of the year. Current estimated backlog of major companies is $330,000,000—about three-fourths of the industry's estimated annual capacity of $470,000,000, or $39,000,000 per month.

Labor Situation

Reports of serious bottlenecks developing in British production of aircraft and other war needs during the first month of the war as a result of shortages of skilled labor (especially tool and die men) and of similar shortages in Germany, have underscored Army fears that in time of war this country might not have enough skilled machinists and mechanics to meet production needs. And even at present, it is known that the air defense program is going to require about 150% increase in personnel.

The immediate need, it is felt, can be met by measures to increase the mobility of available labor. Production on the present defense program will require employment of about 10,000 additional skilled workers. A survey just completed by the U. S. Employment Service shows that throughout the country there are 9,000 unemployed skilled workmen with experience in aircraft. In addition, 79,000 unemployed skilled workers have had experience in related industries.

In order to permit maximum use of this unemployed skill, the Employment Service has prepared listings of available aviation machinists in every locality in the country, and is acting to make the information easily available to the industry.

Chandler-Evans' Plant

The Chandler-Evans Corporation, manufacturers of Ceco aircraft fuel pumps and carburetors, has just completed moving operations from its factory in Detroit to a new plant in South Meriden, Connecticut. The new factory, completed this summer, is located on a five and a half acre tract bordering Meriden Airport. The floor space occupies 15,000 sq.ft.

New Military Orders

Army

The Pioneer Instrument Co., $573,990 for drift meter assemblies.

Aviation Manufacturing Corp., Stinson Div., $1,853,451 for type O-49 observation planes.

Bellanca Aircraft Corp., $181,698, for type YO-50 observation planes.

Ryan Aeronautical Co., $132,020 for type YO-51 observation planes.

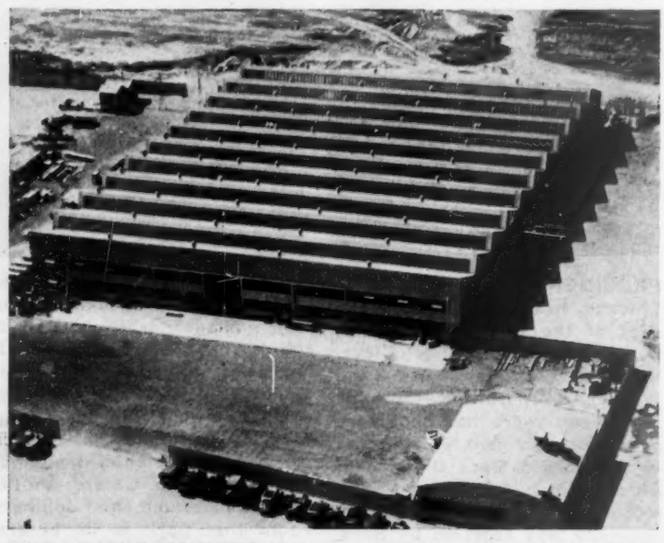
Glenn L. Martin, $16,125,586, for type B-26 bombardment planes.* (See p. 63.)

North American Aviation Co., Inc., $13,049,601 for bombardment planes, type B-25; advanced training planes, type AT-1; basic training planes, type BT-14.*

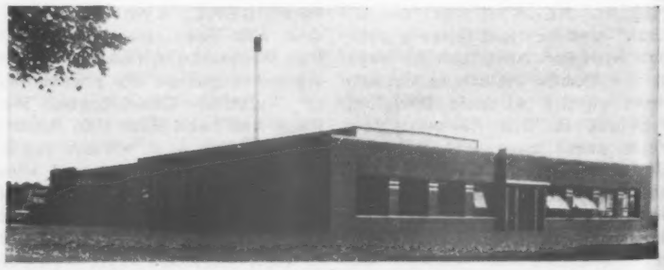
Boeing Airplane Co. (Stearman Div.), $2,843,405, primary planes.

Aviation Manufacturing Corp., $3,029,036, for basic training, BT-13 planes.

Consolidated Aircraft Corp.,

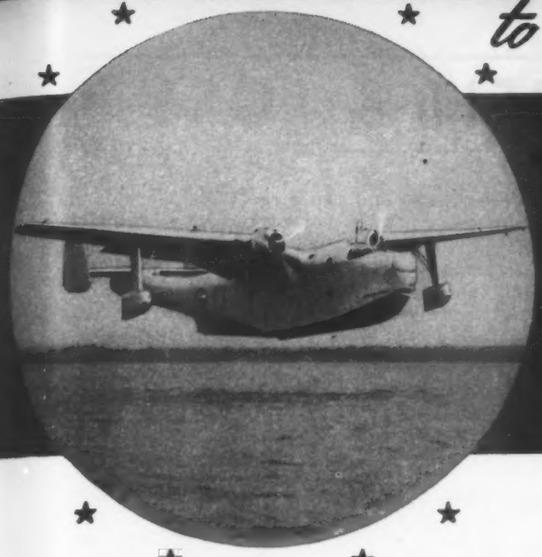


ONE OF THE NEWEST of the new airplane plants is the $150,000 Ryan Aeronautical plant at Lindbergh Field, San Diego. In operation since July first, the new plant has a manufacturing space of 55,000 square feet.



THE CHANDLER-EVANS CORPORATION has recently moved into its new plant located at South Meriden, Connecticut. Until this fall headquarters had been in Detroit following incorporation of the company in July, 1938.

to Extend the Arm of our National Defense



MARTIN

U. S. Navy
PBM-1 PATROL BOMBER

powered by the

WRIGHT *Double-Row* CYCLONE 14

The new Martin "162" Patrol Bomber, designed for the U. S. Navy, is a swift and potent guardian of our far-flung coast lines—an important contribution to our Government's program of National Defense.

A distinctive feature of the ship's appearance is the gull-shaped wings which curve upward from the hull in birdlike lines—developed to secure maximum propeller clearance above the water during taxiing, take-off and landing.

Wright Double-Row Cyclone 14 engines power the "162". Cyclones of this type are now spanning both the Atlantic and Pacific Oceans in scheduled air transport operations. They are proving their dependability on Pan American Airways' four-engined Clippers in service on their trans-Pacific route to China and on their trans-Atlantic routes to Europe.

WRIGHT AERONAUTICAL CORPORATION
Paterson *A Division of Curtiss-Wright Corporation* New Jersey

WRIGHT *Aircraft* ENGINES

$8,613,674 for bombardment planes, type B-17C.

Lockheed Aircraft Corp., $4,653,703, for pursuit planes, type P-38.*

Wright Aeronautical, $6,963,292, for airplane engines: R1820–65 1000 h.p. and R2600–9 1500 h.p.*

Republic Aviation Corporation, (new name for Seversky Aircraft) $3,478,000 for pursuit planes.

North American, $558,000, for airplanes and parts.

Goodyear, $98,235, for wheel and brake assemblies.

Stearman Division, Boeing, $2,843,405, for primary training planes.

Navy

Vought Sikorsky, $1,988,420, for airplanes and parts.

Douglas Aircraft, $716,900 for airplanes.

North American Aviation, Inc., awarded $676,400 for airplanes and spare parts.

Kollsman Instrument Co., Inc., and Pioneer Instrument, Div. of Bendix Aviation Corp., awarded $34,862 for aircraft compasses.

Vought Sikorsky Aircraft Div., United Aircraft Corp., $1,998,420 for airplanes and spares.

Kollsman Instrument Co., Inc., $45,937 for aircraft indicators and spares.

Sperry Gyroscope Co., Inc., $201,600 for gyros, horizon and directional.

Breeze Corp., Inc., $17,050 for aircraft starters.

The Pioneer Instrument Co., $111,290 for oxygen regulator assemblies.

Pump Engineering Corp., $205,067.92 for vacuum pump assemblies.

The General Electric Co., $836,007 for supercharger assemblies.

** Approximated, Aviation, Oct. 1939, page 62.*

Foreign Trade Session

So successful was the Aeronautics Group Session of the 26th National Foreign Trade Convention that council secretaries and participants are resolved the meeting shall be repeated annually hereafter.

Agenda embraced export financing, building of a "cushion" to ease the post-war shock to the industry, selection of foreign representatives, trade promotion, servicing American planes abroad, and significance of Reciprocal Trade Agreements to aeronautics exporters.

No resolutions were taken on any of these points. The meeting was for exchange of ideas. Details for action will be worked out by the Aeronautical Chamber of Commerce and by the Aeronautics section of Department of Commerce.

Vultee Expands

Erection of buildings and installation of equipment to cost an aggregate of $192,000 are now under way at the Vultee Aircraft plant, Downey, Calif. Manufacturing floor space will be more than doubled with an increase to 249,715 sq. ft. from 124,721 sq. ft., in addition to erection of a new engineering building.

Am. Screw Co. Wins Award

The American Screw Company, Providence, took the honors in a cooperative advertising campaign on Phillips Recessed Head Screws. The selection was made by the National Industrial Advertisers Association who named the campaign as one of the twenty outstanding ones of the year.

Whereas sales were previously concentrated largely in the automotive field, today a large percentage of orders are received from the aircraft industry.

North American First

Encouraging increase in profit margins with increased gross business is shown in a recent study of three major Southern California aircraft plants. An interesting side-light of the study is that North American Aviation is shown leading in sales for the first half of 1939, with Lockheed second, and Douglas third. This is partially a reflection of lessening of activity at Douglas as compared with the like period of 1938, and as current hiring is sending the Douglas pay-roll to an all-time high the positions may be reversed.

News From Stinson

Stinson announces sale of six Reliants to three airlines. Four go to Pan American, specially fitted for instrument training, three powered with 300 h.p. Lycoming and one with a 450 h.p. Wasp. Three complete sets of controls permit instruction of two students at once. American Airlines ordered a Reliant with 350 h.p. Wright, bringing its fleet to five. Boeing School gets a Reliant with 250 h.p. Lycoming for instrument training. Gannett Newspapers gets its fifth Stinson, a 5-place Reliant with 260 h.p. Lycoming. Six Stinson "105s" have just been shipped to distributors in Brazil. Stinson "105s" were exhibited at four automobile shows: Detroit, Erie, St. Louis, and Boston.

PROFIT & LOSS

» **United Aircraft Corporation and Subsidiaries,** for quarter ending Sept. 30, 1939, net profit of $2,120,617, equal to 80 cents per share on 2,649,437 shares. For the nine months ending Sept. 30, 1939, net profit of $5,799,307, equal to $2.18 per share, after tax provisions. Compares with profit of $3,564,406 or $1.40 per share in like 1938 period.

» **Lockheed Aircraft Corporation** voted to distribute to its stockholders 51,666-2/3 shares of the Vega Airplane Company stock held by Lockheed. Of the 366,666-2/3 shares of Vega outstanding on September 8, 1939, 283,333-1/3 shares were and now are owned by Lockheed, making the Vega Company a controlled subsidiary of Lockheed, whose ownership, after the above distribution, will exceed 50 per cent. Robert E. Gross, president of Lockheed, pointed out that there being 775,000 shares of Lockheed now outstanding, the dividend in Vega shares will give Lockheed holders one share of Vega for each fifteen shares of Lockheed. The stock dividend was paid October 27 to holders of record October 11.

» **Fairchild Engine & Airplane Corporation** has absorbed its two principal subsidiaries, Fairchild Aircraft Corporation and Ranger Engineering Corporation. Fairchild Aircraft manufactures airplanes, and Ranger Engineering manufactures engines. Savings in taxes and other expenses are expected. Duramold Aircraft Corporation, which is experimenting with molded plastic airplane parts, retains its position as a wholly owned Fairchild subsidiary.

» **Seversky Aircraft Corporation** has announced the change of its corporate name to Republic Aviation Corporation. W. Wallace Kellett, president, stated that "the change was authorized on recommendation of a majority of the Board of Directors, who felt a name of general character would more adequately represent the activities of the corporation. No other changes, corporate, financial or executive were involved in the action of the stockholders." The first contract to be undertaken in the name of Republic Aviation Corporation is the execution of a $3,478,000 order for military pursuit planes, announced by the War Department on September 13th. and the largest single contract ever won by the corporation.

» **North American Aviation, Inc.,** for nine months ending Sept. 30, 1939, net profit of $5,049,617, after tax provision. Compares with net profit of $1,014,491 for the same 1938 period. Sales were $20,995,993 for the 1939 period, against $5,946,987 for the 1938 period. Unfilled orders at Sept. 30, 1939, $27,048,762; at Sept. 30, 1938, $14,805,173.

» **Taylorcraft Aviation Corp.,** for the first six months of 1939, net earnings of $20,284 (before Federal taxes), against $6,799 for the same 1938 period. This represented a 20 per cent sales increase.

» **Kinner Motors, Inc.,** for first quarter of current fiscal year, ending Sept. 30, 1939, net earnings of $6,214, after all charges. This period represents the first three months of operations since Kinner Motors, Inc. purchased all assets of the former company, Kinner Airplane & Motor Corp. Business during this period represents engines and parts shipped to both domestic and foreign customers, and involved manufacture of Kinner engines of 100, 125, and 160 horsepower.

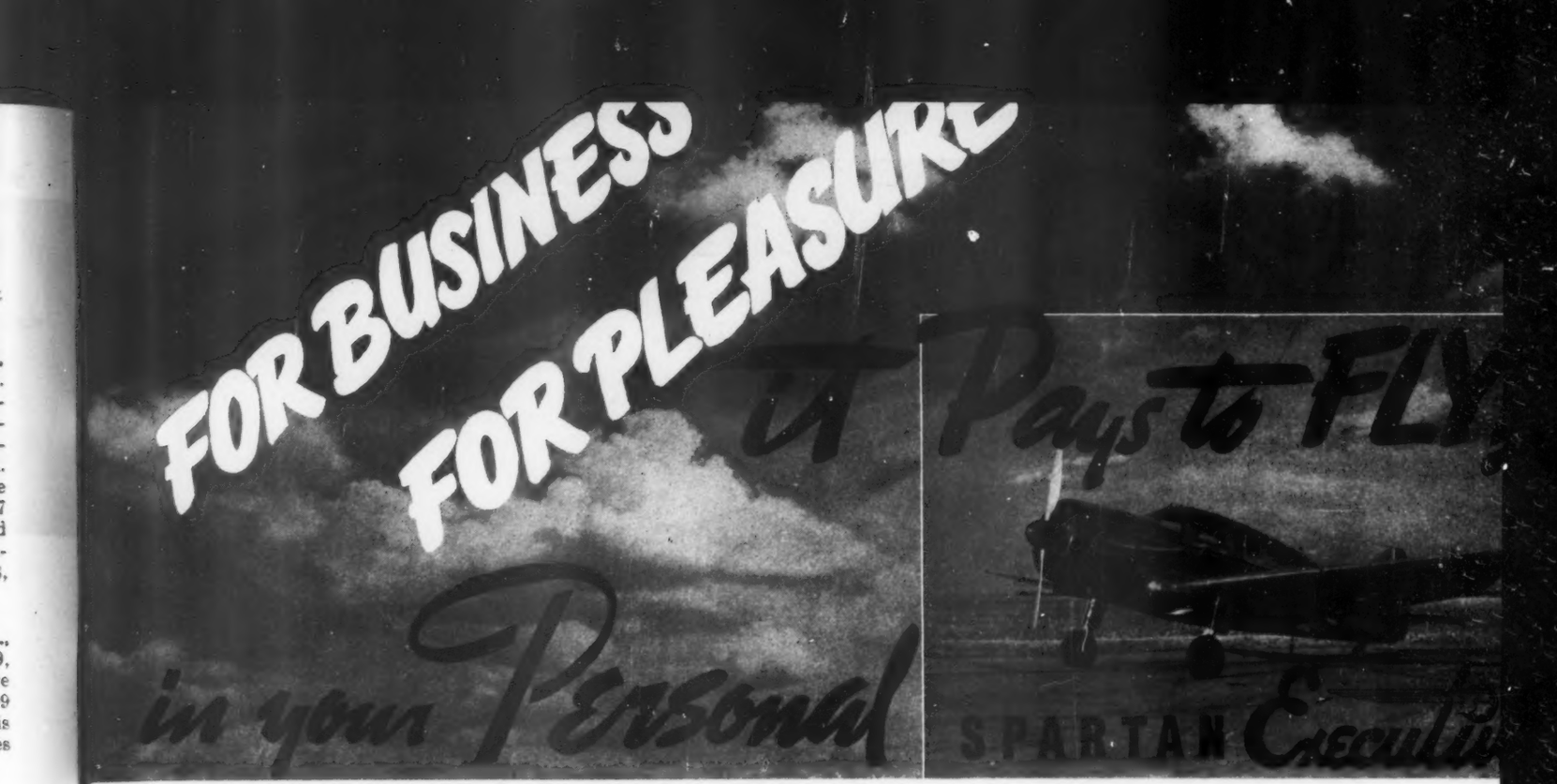
» **Chicago & Southern Air Lines, Inc.,** for the fiscal year ending June 30, 1939, net profit of $69,596, compared with profit of $13,074 for preceding year.

» **Western Air Express,** for month of July, 1939, net profit of $32,000; for August, $29,863; for September, $56,000. This places the third quarter income 24.9 per cent ahead of the same period in 1938.

» **United Aircraft Products, Inc.,** initial dividend of 10 cents on the common stock, payable October 16th.

» **National Aviation Corp.,** indicated net assets at September 30, 1939, $16.48 a capital share, against $14.61 on June 30, 1939.

» **Reflecting a net loss of $183,359** for the fiscal year ending June 30, last, the annual report of Menasco Manufacturing Company, Los Angeles, outlines a plan for bringing in additional capital with which to carry on the major engine development program now under way.



IN your personal SPARTAN ***Executive*** you can fly where you want to go in the shortest possible time—*the time saved gives you more hours for work, saves you more for fun.*

Today the pulse of business beats with the speed of flight . . . while your competitor is on the way, you can BE THERE in a SPARTAN ***Executive.***

An entire new world, in business and pleasure unfolds to the owner of a SPARTAN ***Executive.*** We will be happy to demonstrate how the ***Executive*** will prove a profitable investment for business and pleasure. A phone call, telegram or letter will bring the facts to your desk.

SPARTAN AIRCRAFT COMPANY

TULSA, OKLAHOMA

Inquiries invited from responsible people interested in dealerships.

THE SPARTAN AIRCRAFT COMPANY

ANNOUNCES THE APPOINTMENT AS DISTRIBUTOR

FOR

NEW YORK NEW JERSEY

NEW ENGLAND

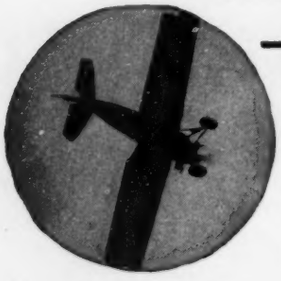
OF

JOHN B. THOMSON

169-18 Hillside Ave. JAMAICA, NEW YORK. Tel. Jamaica 6-5414

Mr. Thomson will announce the name of his Company shortly.

In addition to the training offered at ROOSEVELT AVIATION SCHOOL, its location on ROOSEVELT FIELD is a decided advantage. Here in an atmosphere of never ending aviation activity, ***you will find*** 200 planes permanently hangared and serviced; ***you will find*** 40 buildings devoted exclusively to the aviation business; ***you will find*** 45 operators and their employees doing everything from a minor repair to a complete overhaul; ***you will find*** every type of plane from everywhere coming for inspection and service; ***you will find*** the Eastern Divisional Headquarters of the Civil Aeronautics Authority engaged in issuing certificates to planes, pilots and mechanics; ***you will find*** advanced students, under an Instructor, overhauling, repairing and rebuilding licensed planes of every kind that must be kept flying; ***you will find*** a complete faculty, each member of which is an experienced expert in the subject he teaches. ***You will find*** that these advantages cost you nothing, but add a great deal to the value of ROOSEVELT TRAINING.



WINTER CLASSES START JAN. 2, 1940

ROOSEVELT AVIATION SCHOOL—at Roosevelt Field, Mineola, Long Island, N. Y.

Without obligating me, send details of course checked:

☐ SOLO PILOT ☐ COMMERCIAL PILOT ☐ LIMITED COMMERCIAL PILOT
☐ PRIVATE PILOT ☐ AIRCRAFT SHEET METAL ☐ AIRLINE TECHNICIAN
☐ MASTER AIRPLANE & ENGINE MECHANIC ☐ MASTER AIRPLANE MECHANIC
☐ COMBINATION FLIGHT-MECHANIC

Name.....*Age*.....

Street Address.....*Town*.....*State*.....

A. Nov. '39

Roosevelt Aviation School

Accredited by the U. S. Civil Aeronautics Authority . . . . Licensed by the State of New York

AVIATION TRAINING AT ITS BEST SIGN AND MAIL COUPON TODAY

AVIATION ENGINEERING

Television at 21,000 Ft.

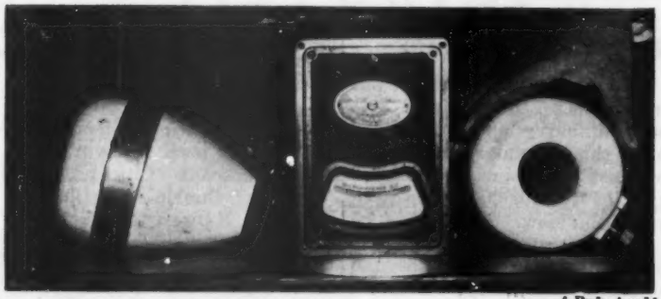
United Airlines and the Radio Corporation of America combined forces on October 16th and 17th to show that television programs can be received at great distances, provided the receiver is high enough. The short waves on which television travels are known to be quasi-optical in character, that is, the waves travel in straight lines and do not bend around obstacles. The limit of reception is that distance at which the horizon interferes with the line of sight between the transmitting and receiving antennas. This effect has been well established experimentally, but never before in so graphical a style.

In the UAL Douglas DC-3, a standard console television receiver manufactured by RCA was installed in the forward part of the passenger cabin. The image was viewed in a mirror under the cabinet lid, which reflected the image back to the passengers, so that picture could be seen clearly from any seat. The size of the picture was about 8 by 10 inches, and it was bright enough to be seen clearly when the side curtains were drawn. On the first of the flights, on October 16th, the plane left Newark and climbed steadily in the direction of Washington, reaching an altitude of about 20,000 feet at a point between Washington and Baltimore. During this time, pictures were received from time to time with considerable clarity. The receiver was operated through a motor-alternator driven from storage batteries. To conserve battery power the set was not operated continuously but whenever it was turned on, images were received, so long as the plane remained above the line of sight to the Empire State Building in New York from which the programs were transmitted. Interference was experienced from diathermy equipment operated in doctor's offices, and occasionally also from a poorly shielded magneto in the left motor.

At 20,000 feet, this motor was shut off and the propeller feathered for ten minutes. The pictures were then received with exceptional clarity. The plane lost altitude at a rate of about 200 feet per minute when on one motor, and at the end of ten minutes had dropped below the line of sight. The picture became obscured with noise and finally disappeared altogether, at an altitude of 18,000 feet. When the plane climbed to 20,000 feet again, the picture reappeared. This was striking confirmation of the line of sight theory, since the distance to the horizon from the Empire State Building (1250 feet high) is 44 miles, and that from the plane (20,000 feet) 174 miles. Hence the total line of sight is 214 miles, or very nearly the same distance as that from New York to Washington, airline.

TELEVISION RECEIVED at high altitude was good except for interference from the doctor's diathermy machine as seen in the top photograph.

21,000 FT. 200 MILE TELECAST RECEPTION was visible from every seat in the plane, being received in a standard television set.



* Rudy Arnold

THE THERMAL GRADIOMETER is one of the newer gadgets invented to make soaring easier. Thermal-couples in the streamlined cones, one mounted on each wing tip, measure the temperature difference indicating the which, where and what of a thermal.

Rotating Wing Conf.

The Second Annual Rotating Wing Aircraft Meeting is scheduled to be held at the Franklin Institute, Philadelphia, on November 30 and December 1. Papers will be presented which will give a rather complete picture of the field of rotary wing design. Among those participating will be : Lt. E. S. Nichols, Air Corps, Capt. John M. Miller, Eastern Air Lines, Igor Sikorsky, Dr. Alexander Klemin, and Dr. George Lewis of the NACA.

Uniform Drawings

A new manual entitled "Aircraft Drafting Room Manual" has recently been written by James G. Thomson, Sales and Service Engineer for Vultee Aircraft. The function of this manual is for the establishment of definite practices for the preparation of engineering drawings applicable to a given industry. Also included is the furnishing of the detail design reference data normally required by the engineering draftsman during the preparation of layout. Aviation Press of San Francisco is publisher.

Thermals Uncovered

Tagged as a "Thermal Sniffer" comes a new device for the improvement of glider soaring. The function of the machine is to aid in the detection of thermal currents, life blood of soaring. In high class language its known as a "Thermal Gradiometer" and bases its operation upon the use of hair-like thermo-couples. A series of these are placed in two streamlined holders, one on each end of the wing, and measure the temperature at each tip. From the differential obtained, recorded by a microamperemeter in the cockpit, the pilot can spot a thermal current.

The instrument was invented by Gustave Raspet, a student at the University of Maryland. The thermo-couple wires are welded together under a microscope and are accurate enough to measure to within one-tenth of a degree.

New Device For Props

News comes that Wright Field has been testing a motor powered gear for changing the pitch of airplane propellers. The device consists of a mechanical motor powered by the engine shaft of the main motor. The reports are that with this system the blades can traverse the entire pitch range in less than ten seconds and also can be adjusted to any angle required for flight conditions.

This motor powered mechanical system is basically the same as a system brought out several years ago using manual operation. The pitch-changing mechanism incorporates the idea of right and left herringbone splines which are enmeshed with bevel gears to move the roots of the propeller blades. The mechanical motor to move the herringbone splines is stationarily fixed between the engine housing and the propeller, weighs only ten pounds and delivers up to three horse power. The gearing is always in mesh and serves as a method of locking the blades. In case the motor fails, an additional hand crank has been installed that will produce the desired results.

TRANSPORT AVIATION

Increasing Air Routes

August airline figures set all-time highs. The scheduled system will carry about 2,000,000 fares this calendar year, with smartest guessers setting a mark of 10,000,000 in the fifth year from now.

Public acceptance of schedule service is being augmented by increasing military, student, private and fixed-base flying. The present "emergency" is booming the demand for airline service. A whole scad of new routes has been applied for and some of them will be allowed. All this calls for additional equipment. Nearly all of the lines are in the market. How much trouble they will have getting it remains to be seen.

It is safe to assume at this time that the lines will not get *all* the equipment they want, but that they will get enough. The federal government will see that the manufacturers do not run out on Air Corps and Navy to get into the export fleshpots. Plane for plane, the scheduled transport system is more important than the military. Quick movement of personnel and emergency goods by air will be indispensable to defense. Good authority predicts that the government will allot an adequate proportion of airplane production to the airlines as well as to the Services.

Referring again to the proposed new routes—if all were certificated the total mileage would be increased about one third, or from about 60,000,000 to 80,000,000 flown miles per year. Considering the often-expressed policy of the Post Office against rapid expansion of the feeder system, you can assume that no great part of the new mileage will be authorized. The PO largely controls extension of the system through its power to put mail on new routes—or not to. Few lines do or could pay their way without mail.

Hearings by CAA on new routes will continue for months. Strangely enough, some operators put in their applications without first checking on the mail possibilities. Of course the Post Office enters the picture officially by testifying at hearings.

Outstanding among new routes applied for (there are some 60 in all) are: Houston-Memphis; Amarillo-Oklahoma City and Memphis-Atlanta; Memphis-Evansville-Chicago with a connection at Louisville or Evansville to Washington; Milwaukee to Michigan peninsula to Duluth and back to Twin cities; Denver-Kansas City; Pueblo-Wichita; Pueblo-Amarillo-New Orleans; Kansas City-New Orleans; the proposed Air Line Feeder System to operate in 13 states, some of it paralleling some of Pennsylvania Central's lines; Oklahoma City-SanDiego.

American Airlines was first in the world to carry its two millionth passenger. AA carried its first revenue passenger on April 1, 1927. Ten years later, Feb. 16, 1937 the system carried its millionth passenger. Company now operates the world's biggest fleet of Douglas planes on its 6775-mile system.

Pennsylvania-Central completed interior redecoration of its Boeing fleet at a cost of $20,000 including new chairs and cabin lining.

Trans-Canada has applied for a foreign air carriers permit to operate between Toronto and Buffalo, carrying passengers, mail and property.

On Instrument Landing

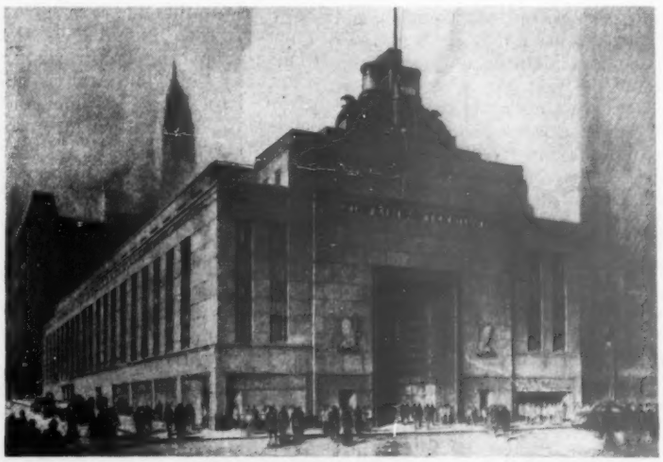
President Roosevelt's request that a standard instrument landing system be pulled out of the hat which contains a baker's dozen of nifty tricks, augurs the end of an old controversy—or maybe revives it. Some technicians argue that aviation should go on experimenting with all possibilities to gain the most knowledge. Others say that everybody will have to get together and pool their efforts on a cooperative basis.

It seems evident that the Civil Aeronautics Authority and the Air Corps got together and put the President up to this move. FDR has asked the National Academy of Sciences to do the job. Some operators complain that NAS is not suited to this branch of research and may take a long time. Others contend it will be a long time before any instrument system is in commercial use anyway. And just between you and some of them who don't want to be quoted, they *hope* it will be a while yet, because if this technique is crowded along, they fear, some airplanes and passengers will be crunched.

Pick Up-Drop Mail Clicks

All American Aviation, operators under a special law of a pick-and-deliver air mail service in the East, is getting inquiries from all over about its hook-on and drop patents. Imperial Airways, Mexican Post Office, Argentine, Canada—and domestic lines have asked for information. Also many Congressmen, urged by their off-line towns to get them on the air system, are investigating.

The company, which is backed by Richard Du Pont, has decided not to apply for additional routes, but to license its rights to other operators. It expects that the existing air lines will apply to CAA for extensions covering communities that have no airports, or if not, then that local interests will apply. All American will ask for CAA certificates for its present two routes, under the assumption its lines will be transferred to the Authority when the legal experimental period expires. The advantage claimed for the pickup system is that it gets outlying community mail to mainline airports for evening departure instead of morning departure after a night train trip.



THE LATEST IN TERMINALS: The airlines are getting together and building themselves an impressive looking building for doing business in New York City. So far Eastern, TWA, American, United and Pan American are represented.

PAA Roundup

After 20 years of overland airways development the pioneers have gone to the seven seas. Another decade or two will see the oceans as adequately networked with air services as the populous lands. The importance of Pan American system in the country's present world relations cannot be overestimated.

Ten thousand persons lined up on both sides of the big pond waiting to go home via PAA when the war started. During the first war month 9476 pounds of mail was carried. At England's request, the Atlantic service picked up Bermuda which was high and dry because shipping was called off. This adds 450 miles to the Atlantic run, but it cuts 330 miles off the jump to Azores.

Weather information, usually taken from ships at sea, was seriously curtailed when said ships blacked out their lights and radio. But PAA saved money by not buying so many reports and applied it to getting better reports from ships that didn't go silent.

Southampton and Marseilles, belligerent ports, were dropped and Ireland and Portugal served pretty well as European termini. PAA set up its own neutrality policy: 1) no passage for persons in belligerent armed service; 2) only inert cargo is mail; 3) all baggage inspected for contraband. It is hoped to increase Atlantic trips to three next summer. The Company has a man-size battle on with weather and war.

South of the States the Company will start a 48-hour service to the most distant Latin capitols. In less than 24 hours after Hitler attacked the Poles South America's Lufthansa shut down, eliminating one of two SA-Europe services and 5000

Announcing . . .

THE NEW *Taylorcraft* TRAINER

The Complete Modern Airplane for Student Training

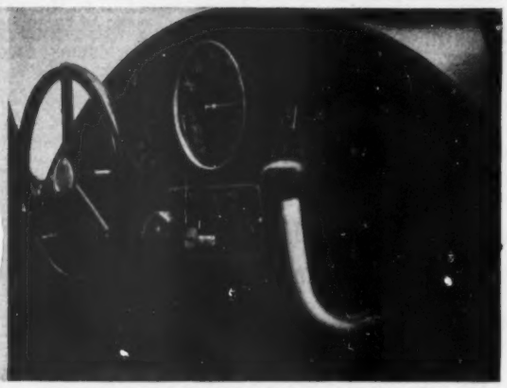
$1495

Powered by Lycoming 50 H.P. Motor F.A.F. Alliance

Low Operating Cost
High Resale Value

Taylorcraft
SAFETY RECORD
FIRST
IN ITS CLASS

Now at Lower Cost



SIDE-BY-SIDE SEATING AIDS STUDENT INSTRUCTION—Student and instructor can easily converse together and closely see the operating technique of each other. Modern private owner planes have side-by-side seating. Train modern!

INTERCHANGEABLE WHEEL OR STICK CONTROL OPTIONAL—Exclusive Taylorcraft modernized stick control permits in one airplane, dual wheel, dual stick, or wheel and stick control with unobstructed floor space—a valuable training feature.

Better Equipment for Operators—Better Training for Students

THE NEW DELUXE 1940 Taylorcraft 65

It's a Sensation!

Write, today, for literature describing this beautiful new airplane.

More complete, more modern, the outstanding training ship for operator and student, alike. That's the new Taylorcraft Trainer. For this low-cost airplane enables the operator to instruct more thoroughly and faster—and turn out better qualified pilots. You have the important advantages of side-by-side seating, interchangeable wheel and stick control in the same airplane, a safety record first in its class, low initial cost and low operating expense, and higher resale value because of Taylorcraft's greater private owner appeal. See and fly this new Taylorcraft Trainer—It's America's foremost airplane for complete primary training and low cost private flying. Write or wire, today, for full details.

TAYLORCRAFT AVIATION CORPORATION

Dept. 115 Alliance, Ohio

miles of coast service competitive to PAA. Air France then suspended so now the only air way between SA and Europe is via the US.

On the Pacific, Civil Aeronautics Authority has determined new air mail rates which, while lower than PAA had asked for, represent a 67% increase over prior revenues. The Authority will take the initiative in a study of South American rates to determine whether or not they are too high.

This Autumn a 40-hour service between California and 70 European cities is expected to result from a hookup of PAA and TWA. The total distance is 6500 miles.

Seattle-Fairbanks service will start next summer if the Government's airport program is carried along. If airports are not available, Alaskans will ask for a flyboat service to coast points.

Los Angeles-New Mexico service will start this winter, and California-New Zealand next summer.

Directors have approved investment of $6,000,000 in multi-engined ships to augment the present fleet of 131. Orders will include six B-314 Boeings.

Air Express Asks CAA

A long controversy looms ahead on air express. Many persons acquainted with this field believe that express traffic might some time yield revenues comparable to present air mail revenue. A dozen years ago when contracts were signed between Railway Express and the air carriers, both parties needed each other to keep newcomers out of the field.

Time has brought up complications. REA is a subsidiary of the railroads and naturally feels no great urge to take traffic from the rails and give it to air. The airlines feel that REA is not putting enough steam behind air express promotion. Now, REA wants from the Civil Aeronautics Authority a certificate of convenience and necessity.

The airlines are opposing the granting of a certificate, because if REA had one it might try to organize or ally itself with purely express air operations in competition with the established air system. On the other hand, if the airlines lost the service of REA, they would have to turn to the Post Office or some other ground delivery service. Organization of a ground service for air express only would not pay. At present the air operators and the express people are pretty much scared of each other. If CAA does not give REA a certificate it could simply approve existing contracts.

New Air Mail Rates

Post Office estimate and request for money to pay air mail carriers in fiscal 1941 has already been submitted to the Budget Bureau. The amount is not disclosed, but outside authorities reckon it at about 25 per cent above the 1940 figure, which is $17,930,000 for domestic and foreign service.

Chances are there will be less pressure on the Hill next session to cut Post Office estimates for air mail. A new service has been set up on the Atlantic, which will command great public interest and meet an urgent need. Rates on the Pacific have been increased. Many domestic rates will have been increased. The vitality of the air system will be considered more than ever essential to the national defense. Only possible reduction in mail carrier costs would be in South America, after the Authority's proposed investigation.

Latest in Union Suits

A new system of negotiating with several groups of airline mechanics at once instead of with a single group is regarded by employers, and apparently by the workers, as an improvement in aviation industrial relations.

A committee for the mechanics and a committee for the employers, representing Braniff, Chicago and Southern, Mid-Continent and Penn Central, met intermittently from Sept. 22 to Oct. 2, which was the date of the Air Line Mechanics convention. At present negotiations are delayed by reason of many CAA rate and route hearings, which require the presence of airline officials.

Mechanics from the first three companies named already had agreements which they desire to amend. Penn Central mechanics are negotiating a new initial agreement. The chief matter of consideration is, of course, rates of pay. There has been very little concern among airline employees about working conditions.

A. P. Martin, former head of the Airline Mechanics Association has been succeeded by Harold Foster, crew chief for American Airlines. Foster is leaving American to devote his entire time to his organization. In the opinion of employers, the mechanics committee has exercised sound statesmanship in its negotiations, taking full advantage of the group proceedings.

Employees say that group dealing avoids uncertainty and distrust between airlines and mechanics, who otherwise sometimes feel that competitive advantages are being taken. The system undoubtedly saves time and expense.

Those who think that the mechanics will expect the Civil Aeronautics Authority to underwrite inordinate wage increases are reminded that Chairman Noble, when CAA was first organized, warned that the new agency was empowered only to determine fair mail rates, that it had no power to subsidize aviation with public money. There is no indication, however, that the mechanics will ask for unreasonably high pay.

Some of the mechanics groups are affiliated with the International Association of Machinists (AFL). The groups that have been negotiating are independent.

TWA Expands

Transcontinental and Western Air last month added 564 miles to its routes when it bought out Marquette airlines, which operates between St. Louis, Cincinanti, Dayton, and Detroit. TWA planes will now connect Cincinnati and Detroit with the transcontinental flights out of Dayton and St. Louis.

Seven-day-a-week flights several times a day will be substituted for the present six flights a week schedule.

TRAFFIC

» **Air Express** shipments in August totaled 74,150, an increase of 27.2 per cent over August, 1938. Gross revenue was increased by 31 per cent over the same month a year ago.

» **American Airlines** logged a total of 21,095,292 passenger miles for the month of September, setting another world's record for commercial airlines. This figure represents an increase of 37.2 per cent over September, 1938.

» **Braniff Airways** for September reports an increase of 31 per cent in passenger revenue over the same month a year ago.

» **Canadian Colonial Airways** clocked a total of 2,151 passengers for September, an increase of 70 per cent over September, 1938, when 647 passengers were flown. These figures are for the Montreal New York run.

» **Chicago and Southern Air Lines** flew 895,510 revenue passenger miles during September, representing an increase of 26 per cent over the same month last year.

» **Eastern Air Lines** reports that for the month of September a total of 8,044,343 revenue passenger miles were flown. This represents an increase of 53 per cent over the same month a year ago.

» **Northwest Airlines** showed an increase of 81.2 per cent in passengers carried in September as compared with the same month a year ago. Passenger revenues increased 63.1 per cent.

» **Pennsylvania — Central Airlines** reports that 2,221,808 revenue passenger miles were flown during September. Still gaining on last year this represents an increase of 32 per cent over September, 1938.

» **TWA** logged a total of 10,475,993 revenue passenger miles for the month of September. This figure represents an increase of 47.04 per cent over the same month a year ago and is the seventh straight record month.

» **United Air Lines** reports that for September a total of 16,880,841 revenue passenger miles has been flown. This represents an increase of 32.8 per cent over the same month last year and sets a new record for the month of September.

» **Western Air Express** has clocked up 8,451,939 revenue passenger miles for the first three quarters of 1939. This gives an increase of 17 per cent over the same period a year ago.

AIR TRANSPORT INDICATOR

November 1, 1939

139.4

Which is the ratio of passenger-miles reported by the Air Transport Association for all domestic lines for September, 1939, to the figure for September, 1938. Trends for the year have continued to fall off but have still managed to keep ahead of last year. For the first nine months traffic stood at 481,469,139 passenger miles—up 28.2 per cent.

AVIATION OPERATORS CORNER

From West Coast Airports

Army, Navy, and CAA training programs, plus an uprush of normal commercial flying brought non-scheduled Fall flying to a new high in Southern California during late September, and October. Several new fields have been opened in Los Angeles county to handle increased student flying, new hangars have been built on established fields, and existing facilities are everywhere bulging beyond normal capacity.

For perhaps the first time in aviation history a major airline was ordered out of a major airport when, late in September, Major C. C. Moseley gave American Airlines 30 days' notice to vacate Grand Central Air Terminal. Need of increased space for Curtiss-Wright Technical Institute of Aeronautics was the reason for American's ouster. The move will release approximately 35,000 square feet of space for classrooms, shops, and offices. American Airlines moved to Union Air Terminal on October 10th, necessitating enlargement of the terminal office building there. Pan American Airways continues to operate from Grand Central Air Terminal.

Major Moseley also moved to provide adequate flying field facilities for his portion of the Army flight training program by taking a lease on a field at Tarzana, San Fernando Valley, about 15 miles from Grand Central Air Terminal. The first class of cadets to graduate from Grand Central Flying School, twenty-six in number, were given their diplomas (orders to report for instruction at Randolph Field, Texas) by Capt. E. M. Day, on September 30. The twenty-six were survivors of an original class of 37. All training has been conducted without incident. Meanwhile like scenes were being staged at the cadet training centers in San Diego and Santa Maria, where Ryan School of Aeronautics and Hancock School of Aviation are conducting cadet training work.

Naval cadet instruction commenced October 1st at Long Beach airport with a class of twelve students taking instruction under the supervision of Commander Thomas A. Gray. Graduates of this class are sent to Pensacola for advanced instruction.

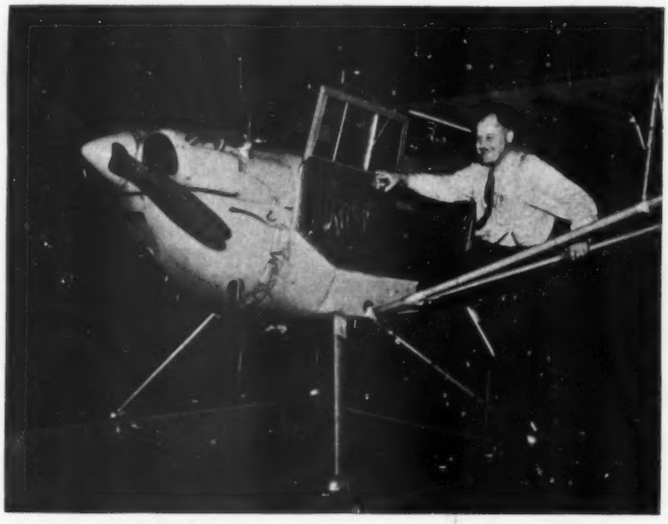
The CAA program of civilian flight training, as in other parts of the country, is now in the ground training phase. But various selected schools throughout the West are polishing up their flight facilities, buying new training planes or overhauling their current equipment, and studying up for efficient administration of the controlled flying course under the general supervision of C. F. Lienesch, senior CAA private flying inspector on the Pacific Coast.

September Soaring Shows

Seeking to establish a permanent soaring site in the Los Angeles metropolitan area, a series of soaring shows was staged during the month of September on Vail Field, East Los Angeles, former home of Western Air Express. Jointly sponsored by the Southern California Soaring Association and the Licensed Airmen of America, the area was given a thorough tryout through the cooperation of the California Flyers who donated a Fleet trainer flown by Ross Seeley, chief pilot, to tow various soaring planes aloft for testing thermal currents in the area. Auto tow launching and winch launching was also tried and numerous promising soaring flights were made, demonstrating that soaring can be done from this flat area, on almost any day of the week. Pilots participating in the meet included Vollmer Jansen, Horace Tennes, John Robinson, Frank Hutchinson, Wm. G. Briegleb, Dr. Wolfgang Klemperer, Speed Westphal, Howard Morrison, and others. About ten sailplanes were flown.

Those with low blood pressure should plan to be on hand at the N. E. Philadelphia Airport to absorb some of the "pulse-throbbing" speed demonstrations planned for the Legion Air Races. These races are all set to be Philadelphia's A No. 1 air show and will be held on October 29th with a rain date for November 5th.

BIRTH OF AN AIRPORT: About 100,000 Pennsylvanians turned out to see the air show put on for the dedication of Reading's new Municipal Airport. Steadham Acker (left) came up from Birmingham, Ala., to help Melvin Nuss (third from left) put on the show. Your correspondent (second from left) and Bob Aldrich (right) from Troy, N. Y., came over to give fatherly advice.



PILOT'S HOLIDAY: New Orleans Standard Oil Dealer Henry B. Chapman, passed Columbus Day flying home non-stop from Floyd Bennett Airport in his Aeronca 65 seaplane. Here he is shown after he completed the 1120 mile flight in 13½ hours. He took off with 80½ gallons of gasoline.

As we go to press word comes from California that the dry-land seaplane endurance flight still goes on, now in its fourth week, with the two pilots past the 500 hour mark and heading for the all-time refueling endurance record of 653 hrs. 34 min. The plane, a Piper Cub, is being flown by Clyde Schlieper and Wes Carroll over the Mojave desert near Rosamond Dry Lake.

Dedication of the Gardena Valley Commercial airport, Southern California, was staged Oct. 21, with Prof. Earl W. Hill, National president of Alpha

TAYLORCRAFT FLEET: Tony Little's Patco Field is full of light planes.

Eta Rho, aviation fraternity, presiding. Prof. Hill is head of the aeronautics department at University of Southern California and is directing a portion of the CAA program, with flight instruction for his group to be given on the new Gardena Valley Airport under Alvin Eager. A special mailing cachet was arranged for the opening day of airport activities. The new field is in flat country, well drained in wet weather. Runway area measures 1360 by 4000 ft., with the major measurement in the direction of the prevailing wind. A single wood and steel hangar, 40 by 120 ft., has been erected on the field.

An all-light plane race meet and stunting show drew thousands of spectators to the Martin Airport, Santa Ana, Calif., on Oct. 13–14. The show was staged under the official sanction of the N.A.A. and drew entries from all of the 11 Western states, with scores of lightplanes being flown in by private pilot spectators. Cubs, Taylorcrafts, Aeroncas, Luscombes, Porterfields, and others, vied for favor in stunting and pylon racing. Feature event was won by Tony LeVier.

Eleven states had statutes, as of Dec. 31, 1938, expressly providing for exercise of state police power governing the erection of structures in the vicinity of airports. Legislation even allowed the police to compel the removal of existing obstacles if they would be hazardous to the landing and taking-off of airplanes. It seems, however, that only in two of the states was the statute clearly designed to accomplish the latter purpose, while nine statutes seemed to have resulted in a system of "airport zoning".

One of the new laws of the CAR for flying schools, begins with a statement that the applicant shall show that a landing field is available for use in giving flying instructions, which seems like a pretty good idea. Several specifications regarding the type of field were made, however, as well as minimum dimensions for various conditions. One of the requirements is that the landing area surface shall be suitable for the safe take-off and landing of aircraft under normal weather conditions and shall be marked in accordance with the requirements prescribed by the Authority. Also each landing strip shall be in such condition that an aircraft at any point on it shall be visible from any other point on the strip. The new law takes the amendment No. 27 of the CAR.

SHOWMAN: The camera caught Manufacturer Ed Porterfield during his display of wares at the Kansas City Municipal Airport dedication.

REPORT CARD

Of Air School

Having the largest enrollment in the history of the school, the Rising Sun School of Aeronautics, Philadelphia, opened its doors to the fall term. Because of the number of students, the only new ones that will be accepted will be those to replace the ones graduating. Among the new equipment that was added for the students to work on were a Grumman XSF-1, an O2U Vought and a Martin T4M. In addition to these have also been added two Wright Cyclones of the F-11 series, as well as several new type carburetors and magnetos.

Additional new equipment and new courses have been added by the Warren School of Aeronautics, Los Angeles, to meet the current demand for trained aircraft workers. Departments added include an instrument course, tool-making instruction, arc welding and aluminum welding. Additional machine shop equipment has been installed and additional instruction offered.

A surprising lack of basic shop training among European aircraft engineers with whom he was in contact, was reported by Curtis L. Bates returning to his post as Chief Engineer of Aero Industries Technical Institute, Los Angeles, after spending three months in a consulting capacity with the Svenska Aeroplane Works, Linkoping, Sweden. Although such engineers have the highest educational background, there seems a lack of appreciation of the value of detailed shop instruction such as is provided at American aircraft mechanic schools.

TAGGING THE BASES

with LES NEVILLE

Training Hazards

Colleges will be pouring out pilots before many moons and the skies will be full of light planes. Three hazards, all beyond federal government control, are beginning to worry the boys concerned with the conduct of the program. (1) Traffic supervision at airports is inadequate and there isn't much the C.A.A. can do about it because the operations are intrastate. (2) Some recent experience indicates the possibility of carburetor icing is one that is more serious than it was believed to be. (3) The danger of overconfidence is ever present. A fourth hazard which can be remedied by C.A.A. is the inadequacy of cross country experience provided in the controlled course. It is only by recognition of these pitfalls, and close cooperation of students, operators, and the C.A.A., that the enviable safety record of the experimental program will be maintained.

Some college boys don't want to go to war. This is clearly indicated by the misunderstanding of the purpose of the C.A.A. Training Program which has been found to exist within the student bodies of some institutions. In one case only three applicants were obtained until it was explained that the C.A.A. program had no service strings tied to it. Then the number jumped to 90. The C.A.A. has made a sincere effort to keep its program on a strictly civil basis. Naturally some of the pilots it turns out will be suitable for military training. But there will not be many, if we are to be guided by England's experience with the Civil Air Guard. Our Army and Navy have very high requirements for pilots and neither branch is completely sold on the use of civilian trained men as a basis for the development of officer material. The government training programs of Italy and Germany are frankly military. England's Civil Air Guard entailed a strong service obligation. Nowhere in the world is there an opportunity for flight training as free of militarism as our own.

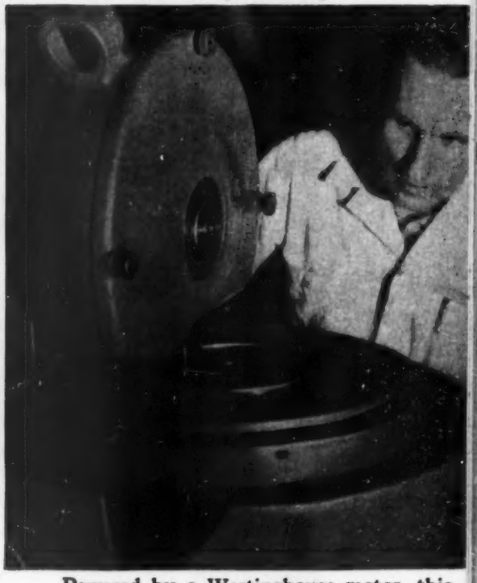
Encouraging symptoms of cooperation are cropping up all over the aeronautical horizon. One of the most recent turned up at the dedication of Reading Municipal. When hard-laboring Melvin Nuss was about to give birth to his airport he wanted to give the new baby an appropriate christening so he looked around to find the best man to put on an air show. Knowing of the success of Birmingham's Annual Air Carnivals, he called on Steadham Acker for assistance. Steadham dropped everything, moved into Reading, and, working with Mel Nuss, planned and executed one of the finest dedication programs on record. His services were given without charge to the city. Reading responded with an attendance up around the hundred thousand mark. Such cooperation is a clear indication of the stature of the men who are managing our airports.

Understood to be the first step in a plan to bring advanced engineering training to the employees of various aircraft plants, twenty-five employees of North American Aviation, Inc., Inglewood, Calif., have organized a study group and enrolled in Basic Stress Analysis courses with the Westwood Correspondence School, according to Gordon Brown, president of the school. The North American study group has been organized under the direction of Russell Barr, confidential design engineer at the North American plant, and has been approved by executives of North American Aviation. Eric Martin, North American structural design engineer, has been named by the group to direct their study activities.

PERFECTED SERVICE · WITH WESTINGHOUSE

Fast and efficient servicing crews, backed by equally efficient shop equipment, are a necessity in modern air transportation.

Westinghouse air conditioning equipment eliminates dust and moisture in air line laboratories where sensitive flying instruments are periodically checked.



Powered by a Westinghouse motor, this magnetic grinder resizes piston rings in the shops of a prominent transport company.

Modern Westinghouse welders with one-man control make alloy welding easy.

WESTINGHOUSE ELECTRICAL EQUIPMENT FOR SERVICE AND MAINTENANCE BASES

SINCE the beginning of Aviation, Westinghouse has realized the tremendous responsibility placed upon service and maintenance. Keeping pace with these requirements, Westinghouse has placed special emphasis on electrical equipment for service and overhaul bases. Whether your maintenance requirements include motors, control equipment, welders, lighting equipment or battery chargers, you will find the latest Westinghouse electrical equipment available in 35 well-equipped service shops and 27 well-stocked warehouses. Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pennsylvania. Dept. 7-N.

Send for your copy of "FLYING"—the new and interesting Westinghouse book on Aviation. Simply fill in and mail the coupon.

Westinghouse Electric & Manufacturing Company,
Department 1119,
East Pittsburgh, Pennsylvania.

Please send your new book — "FLYING" — to me at the following address:

Name .....

Firm .....

Street Address .....

City ..... State .....

J-93366

Westinghouse

W
WESTINGHOUSE ELECTRIC

Instrument Landing on 40 Centimeter Waves

(*Continued from page 27*)

ments for plate and grid, as well as tuned elements in the filament leads. The plate circuits were fed from conventional audio frequency modulator equipment, providing an input of about 20 watts, modulated at 90 cps in one case and 150 cps in the other. The accompanying illustration shows the oscillator units. Both were tuned to approximately the same frequency, although one unit was designed for operation at lower frequences than the other, and hence has longer physical dimensions.

The receiving equipment

The receiving equipment is of the superheterodyne type. The receiving antenna is a "coaxial" antenna (developed by the Bell Telephone Laboratories), and was fastened to one of the wing struts (see photograph). The antenna leads directly to a diode tube (a Western Electric experimental type) which acts as the first frequency converter. The 700 Mc input signal is mixed with a 690 Mc oscillator signal, derived as the third harmonic from a 955 acorn tube in an oscillator circuit which operates at 230 Mc fundamental. The 10 Mc intermediate frequency (which results from mixing the 700 Mc signal and the 690 Mc oscillator harmonic) is then passed through two i-f amplifier stages employing 1852 tubes, and thence to a 6SQ7 which acts as the second detector, a-v-c and first audio amplifier. A-v-c voltage is applied to the two 1852 stages. The audio output of the 6SQ7 is then fed to an elaborate a.v.c audio amplifier, employing four 6SK7 tubes, the first connected as a triode, the next two as pentodes and the last as a triode. There were two principal reasons for using the audio a-v-c circuit. First we originally intended to test a simple grid-leak detector receiver as well as the superhet, which made audio a.v.c. a necessity. Second, we had no clear idea of what magnitudes of signal voltage we could obtain, and consequently we prepared to handle a very wide range of voltages. A 6R7 tube is used as an a-v-c diode and amplifier to control the gain of these audio amplifier tubes. The coupling of these amplifier tubes is of the band-pass type which passes the 90 and 150 cps modulation but restricts the gain at frequencies lower than 50 cps and higher than 400 cps. This is necessary in order to reduce the noise and to maintain stability.

The final audio output, containing 90 and 150 cps components is then passed through a filter which separates the 90 cps from the 150 cps. The separated signals are then amplified in the two sections of a 6F8G double triode, applied to copper-oxide rectifiers and combined in a bridge circuit with the indicating meter as the diagonal element of the bridge. The overall gain is such that 5 microvolts of signal applied to the first 1852 i-f stage, modulated 50 per cent either at 90 or 150 cps will produce 1.5 ma rectified d-c in the meter coil. The loss of gain in the diode first detector is hard to calculate, but a rough guess indicates a loss of about 3-to-1, which would necessitate an input signal of 15 microvolts for the output just mentioned. The a-v-c action of the audio system is such that the output indication is substantially independent of audio input voltage from about 3 millivolts to 3 volts.

The three-spot indicating system

One of the major aspects of the demonstration was to show that the original Metcalf system of indication, the three spot method, could be put into practice in flight. The feasibility of the system was, in your editors opinion, conclusively demonstrated with the one reservation that the weight factor is, at present, too high. Otherwise the three-spot indicator seems to be one of the most significant instrument consolidations yet developed.

The filtered audio output of the receiver (90 and 150 cps separated) is conveyed to an adapter unit which consists of an amplifier and rectifier of somewhat higher voltage and current capability than that used with the meter indicator. The d-c output of the rectifier is applied to the control commutator associated with the cathode-ray indicator. This commutator applies voltage to the cathode-ray tube vertical deflection plates in such a way that the center spot of the three spots on the cathode-ray screen is moved up or down depending on whether the 90 cps or the 150 cps component predominates. This produces the vertical guidance. Horizontal guidance was obtained from the localizer transmitter (conventional long-wave unit operated by the Washington Institute of Technology). The output of the localizer receiver was applied to the horizontal deflection plates of the cathode-ray tube through the commutator. A d-c component was also obtained from the electrical pick-up associated with the directional gyro, while variable d-c was obtained similarly from the artificial horizon instrument. The complete indication of the blind receiver equipment, the gyro and the horizon were thus brought out on the face of a single indicator.

Details of the Demonstration Flights

Your reporter had the opportunity of watching the system in operation in the cockpit of the plane on two approaches to the field. The first impression was that a very great deal of apparatus had been crowded into the plane, but the operation was extremely simple. The power supplies were turned on (there were two in use, one for the receiver and one for the cathode-ray tube indicator and its auxiliaries). After a brief warm-up period, the three spots appeared on the cathode-ray tube screen, and took up their proper positions. The spots were bright enough to be seen without eye-strain, even though the cockpit was filled with sunlight. The pilot flew about five miles from the airport, turned, and picked up the glide path at an altitude of about 1500 feet. Thereafter he maintained the three spots in a straight line, horizontal and centered on the screen. As the glide path was followed, the rate of climb and airspeed indicators maintained constant readings, showing definitely that the glide path was straight. Flying the path was extremely simple, or so it seemed to the innocent bystander, since beyond correcting for the effects of rough air, there was no observable change in the attitude of the ship from five miles out, to the airport edge.

Contact was not made with the airport surface because of a crosswind (now considered standard equipment for blind-landing demonstrations), but it was obvious that a perfectly definite point of contact was available on each approach to the field. During the course of the day some 15 or 20 approaches were made, and on all except two (when the localized transmitter was out of adjustment), the ship reached its lowest altitude over an area no larger than 50 feet in diameter. It

(*Turn to page 78*)

Safety

NO BRUSHES · NO SLIP-RINGS · NO SLIDING CONTACTS

THE KOLLSMAN TELEGON REMOTE INDICATING SYSTEM OPERATES ENTIRELY BY INDUCTION

Because the remote indicating system reaches into every part of the airplane—because sometime, somehow, some piece of distant equipment in this system may be in the presence of gasoline vapor—it is absolutely essential that the system be explosion-proof.

The Kollsman Telegon Remote Indicating System operates entirely by induction. It has no brushes, no slip-rings, no sliding contacts of any kind to cause a spark. It is supremely safe as well as superbly efficient.

Kollsman Telegon is the *only* remote indicating system in use to-day which operates entirely by induction. Over 6,000 units in service testify to its efficacy. It is to-morrow's system *to-day.*

KOLLSMAN INSTRUMENT COMPANY, INC.

8008 FORTY-FIFTH AVENUE ELMHURST, NEW YORK

WESTERN BRANCH: GRAND CENTRAL AIR TERMINAL, GLENDALE, CALIFORNIA

Tethering the Airplane

(*Continued from page 31*)

tying the tail down. Most manufacturers now provide lift handles attached to the lower longerons of the airplane at or near the stabilizer. These should be quite satisfactory for tying down the tail. In the absence of suitable handles, ropes may be attached to the tail wheel or tail skid. When the airplane is provided with a tail wheel lock, the tail wheel should be locked in the fore and aft position.

Some operators favor tying the airplane down by means of the landing gear. Among the reasons for favoring this, are that it automatically holds the wheels in their proper place and the wheels provide a certain amount of shock absorbing to the gust loads encountered. There are disadvantages, however, to this procedure. The airplane is not necessarily adequately restrained from rolling laterally if the wind should veer around in a lateral direction and we must always bear in mind the possibility of the wind shifting. If the shock strut is of the oleo-steel spring type or any other type which taxies in a substantially compressed attitude, there is the possibility of wind getting under the wings, creating enough lift on one or both wings to put the shock absorbers in tension, thus extending them, thereby increasing the angle between the wing and the ground. If an airplane having this type of shock absorber is tied down by means of the landing gear it should also be tied down directly at some other point or points. If the airplane is a tractor, ropes might be looped over the propeller hub and tied to the ground.

The airplane with the tricycle landing gear presents a similar problem in this regard. Probably the best method of tying down such an airplane is to head it into the prevailing wind, block the wheels, tie the wings down to stakes or anchors in the ground and similarly tie the nose of the airplane down. If the nose wheel oleo is of the type that is normally in the extended position when the airplane is on the ground, the rope may be looped over the wheel axle. If on the other hand, the oleo is either in the compressed attitude or only partially extended, the rope should be looped over some part of the landing gear structure above the shock absorber and firmly tied down.

In mooring seaplanes, care should be taken to have adequate anchorage, also a sufficiently long rope between the anchor and the seaplane or buoy. A short rope, especially in deep water, will tend to result in pulling and dragging the anchor. If the bottom is of rough rock, soft sand or mud, a heavy weight may be adequate. If, on the other hand, the bottom is relatively hard and smooth, an anchor with suitable sharp pointed flukes that dig in, should be used.

It is probably desirable in the case of small float seaplanes to beach them in stormy weather, especially if the water is quite rough. A practice of tethering seaplanes on dry land so that they will not blow away is to fill the pontoons with water. The spread and length of the pontoons give an excellent base and with the pontoons filled, there is adequate weight to keep the plane from blowing away. A seaplane either in the water or on dry land has the advantage of the tricycle landing gear, namely that it is in a substantially horizontal attitude. The lift on the wings will therefore be relatively small. When it is impractical to beach the seaplane, the floats may be partially filled with water to prevent "flying at the anchor". In the case of boat and single float seaplanes, the hull or main float may be partially filled with water and the tip floats filled. At first thought it may appear that the filling of the tip floats would destroy the lateral water stability of the seaplane. Actually this is not the case. If one of the tip floats tends to sink, the opposite float tends to be lifted out of the water. The weight of this float and the water it contains provides the necessary righting moment. Another procedure is to tie an oil barrel full of water to each wing, the top of the barrel being just below the surface of the water. When submerged, the load on the rope is equal to the empty weight of the barrel only. On the other hand if the wing lifts the barrel out of the water the load on the rope is equal to the weight of the barrel plus the weight of the water it contains. As water weighs approximately 8.5 pounds per gallon this provides a large righting moment.

In tethering aircraft, it is desirable that a good grade of Manilla hemp rope be used. This rope should, of course, be in good condition without worn portions in the strands. Manilla rope is approximately 50 per cent stronger than cotton, has greater durability, is more resistant to weather conditions, and is less expensive than good quality cotton rope. Cotton has a tendency to shrink considerably when wet. Such shrinkage might tend to pull the stakes or strain the structure. Steel cable should be avoided as it lacks the resilience of hemp rope therefore in the case of gusty weather the airplane would tend to pound against the cable. These sudden jerks would not only be detrimental to the airplane but would also tend to pull the stakes out of the ground.

In tying an airplane down, the knot should be of a type that can be made tightly, that will not slip and which may be readily untied. Probably the best procedure would be to tie a knot such as a bowline in the loop provided in the wing of the airplane. (See Fig. 2) This knot requires slack rope. The other end of the rope could then be looped through a ring in the ground anchor and tied with a midshipman's hitch. (See Fig. 3)

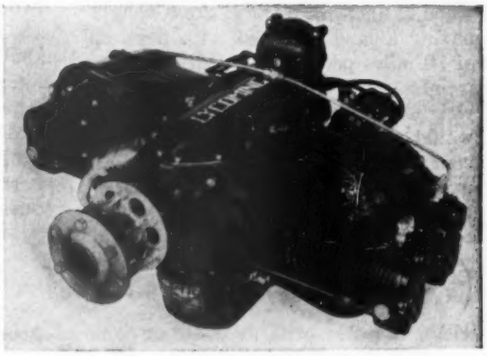
An excellent little booklet entitled "Useful Knots and How To Tie Them" may be obtained from the Plymouth Cordage Company, North Plymouth, Mass. It is difficult to say what size of rope should be used for tying down a given size of airplane, as the loads imposed upon the rope are dependent very largely on the size of the airplane, the wing loading, the manner in which the airplane is tied down and the wind velocities encountered. As a means of arriving at some sort of rough criterion we may consider the following: An airplane with a light wing loading would be the most adversely affected by a wind storm. As an example we might consider a light plane having a gross weight of approximately 1000 lbs., an empty weight of approximately 600 lbs. and a landing speed fully loaded of about 40 mph. Such an airplane moored out on an airport in the 3 point attitude and in an empty condition would tend to fly as a kite at approximately 30 mph. Let us consider the possibility of this airplane being tethered out in a gale of 60 mph. As this is twice the speed at which the airplane would tend to fly as a kite and as the lift varies as the square of the velocity, the lift would be four times the empty weight or 2400 lbs. The pull on the ropes would be 2400 lbs, minus 600 lbs., which equals 1800 lbs. The lift per rope (one rope on each wing) would

(*Turn to page 78*)

A row of Aeronca Chiefs, powered by the Lycoming O-145 Engine —a few of the many Lycoming-powered light planes such as Taylorcrafts, Cubs and Aeroncas in the CAA Civilian Training program.

Lycoming Light-plane Engines Play Important Part in CAA Civilian Training Program

THE same basic excellence prompting the United States Army's selection of Lycoming engines for military trainers, underlies the Lycoming O-145 light-plane series selected for Cub, Taylorcraft and Aeronca training ships. Dependable 50, 55 and 65-horsepower aircraft engines, ideally suited to student training because of Lycoming's smooth, balanced quiet operation . . . factors which contribute much to the student's peace-of-mind in the important early stages of instruction . . . and because of its outstanding economy of operation and inherent reliability. Ask your Aeronca, Taylorcraft or Piper Cub dealer for a demonstration behind a Lycoming, and discover why operators the country over are specifying "power by Lycoming" for ships participating in the CAA Civilian Training Program.



LYCOMING O-145 SERIES: Economical, dependable engines of 50, 55 and 65-horsepower. Four cylinder, horizontally opposed, air-cooled, single or dual magneto ignition.

Send for FREE Literature!

Illustrated, completely descriptive folders on Lycoming light-plane engines are available at all Aeronca, Piper Cub and Taylorcraft dealers. Or write Department A119, Lycoming Division, Aviation Manufacturing Corporation, Williamsport, Pa., U. S. A. Cable address: Aviatcor.

YOU CAN RELY ON

LYCOMING

50 to 300 H.P.

Engines

FOR MILITARY AND CIVILIAN TRAINERS ★ FOR PRIVATE AND COMMERCIAL PLANES

Tethering the Airplane

(*Continued from page 76*)

therefore be 900 lbs. Allowing a factor of 2 for the weakening effect on the rope of knots, and a safety factor of 1.5 we have an ultimate factor of 3. It might appear that an ultimate factor of 3 is rather small. It should be borne in mind, however, that the conditions are rather severe. It would appear to be the height of folly to leave an airplane tethered out in a sixty mile per hour gale without taking any steps to reduce the lift of the wing by one of the methods outlined above. With an ultimate factor of 3 we would require a rope having an ultimate strength of about 2700 lbs. From Table III we find that a ½" rope has an ultimate strength of 2650 lbs. This would doubtless be adequate. If on the other hand the airplane was tethered in such a manner that the wing was at an angle of attack of half that of the three point landing conditions or less, the size of the rope could be cut down accordingly. Doubtless for such a condition a rope of ⅜ inch diameter would be adequate.

Let us consider a transport airplane of about 25,000 lbs. gross weight having a landing speed with flaps up of 70 miles per hour. With an empty weight of 60 per cent of the gross weight (15,000 lbs.) such an airplane would tend to fly as a kite at 77 per cent of 70 MPH which is approximately 54 MPH. In a 60 MPH wind the lift that the ropes would have to overcome would be:

$$\left(\frac{60}{54}\right)^2 - (15000) - (15000) = 3500$$

Using a factor of 3, the load per rope would be $\frac{(3)(3500)}{2} = 5250$ lb.

a ¾" rope has an ultimate strength of 5400 lbs. In its service manual one of the airlines recommends the use of a ¾" rope for tethering a Douglas DC-3. From the above it is readily seen that the airplane having a light wing loading is the one most likely to suffer from wind storms.

The problem of achieving adequate anchorage into the ground is not a simple one. If stakes are used they should be of considerable size and even then cannot be relied upon too thoroughly in soft sandy soil. Undoubtedly the best anchorage is obtained by setting a metal ring in concrete or by fastening an eye bolt with ring into a timber such as a railroad tie, buried several feet below the surface of the ground. Such an anchorage should be quite reliable. The greatest pull on the ropes would come during gusts. This pull would be resisted by not only the weight of the anchor, but also, if the anchor started to move, by its inertia and by friction.

As a rough criterion it would appear that the minimum weight of each slab of concrete should be equal to about half of the ultimate strength of the rope to be used. Concrete weighs 140 lbs. per cubic ft.

Where stakes are driven into the ground it might be advisable to drive two or more stakes at angles to one another such that they cross just above the surface of the ground. The intersection of the stakes can be tied together with rope and the airplane tied down to this intersection. As this problem does not lend itself to even a rough analysis, it is just about impossible to give any reasonable criterion as to what might be considered satisfactory. In any case, one should be sure that there is adequate anchorage. There cannot be too much!

For temporary use special metal stakes made in the form of a helix have been successfully used. These are screwed into the ground like a cork screw. Another type in use is driven into the ground but has barbs or flukes which resist any attempt to pull it out.

In conclusion, if the airplane is to be left out in the open, suitable more or less permanent anchorage should be provided, together with a sufficient quantity of first class manilla rope. As a matter of routine practice the airplane should always be tethered when not attended by operation or maintenance personnel. Wind storm damage inevitably occurs when least expected. It is better to take routine precautions than to have one's profits (and principal) blown away by a sudden squall.

Table III

Rope Diameter	Ultimate Strength in Manila Rope
¼"	600 lb.
5/16"	1000 lb.
⅜"	1350 lb.
7/16"	1750 lb.
½"	2650 lb.
⅝"	4400 lb.
¾"	5400 lb.

Table IV which is based on the above, contains recommended minimum rope sizes for various sizes of aircraft.

Table IV

Gross Weight of Airplane	Recommended minimum rope sizes	
	Tethered in three point attitude facing wind, without spoilers.	Tethered in approximately level attitude or with spoilers mounted on wings.
Up to 2000 lb.	¼" Rope	⅜" Rope
2000 lb. to 10,000 lb.	⅜" Rope	½" Rope
10,000 lb. to 25,000 lb.	½" Rope	⅝" Rope

Instrument Landing

(*Continued from page 74*)

seems perfectly safe to assume therefore that the system will provide a definite point of contact because the glide path actually remains straight until it hits the ground. This is very different from other blind landing systems in which an equipotential contour is followed, since such contours tend to be parallel to the airport surface for the last several hundred feet of the glide path.

On the second approach in which your reporter took part, the pilot intentionally flew above and below the path, and kicked one wing down to show the effect of improper attitude on the indicating instruments. This was perhaps the most illuminating part of the demonstration since the three spots then very definitely gave the psychological impression of three points fixed in space, against which the plane position and attitude could be gauged.

The next step in the development is now being taken under consideration. Meanwhile it seems certain that the demonstration will serve to show that the ultra-ultra high frequencies are feasible for use in above-airport navigation, and that the Metcalf system and the straight-line glide-path as developed by M.I.T. offer advantages which have not yet appeared in other systems.

The Birdmen's Perch

For those red-blooded pilots who admire nothing more than a chance to get all revved up swapping yarns that soar to the stratosphere, the Perch still offers the world's shortest-cut to a sheepskin. One of our Whopper Diplomas goes each month to the liar spinning the whoppingest story with Gulf Aviation Gas as its hero. Simply send your entry to:

"Tattered Wing-Tips,"
Editor, "The Birdmen's Perch,"
Room No. 3800, Gulf Bldg., Pittsburgh, Pa.

SISTERS-UNDER-THE-SKIN DEPT.

Pinochle widows and Gulf refining engineers might not seem to have a lot in common . . . but they have!

No wife is satisfied that she has flushed all the winnings out of the old man's trousers with just one shake. She's a cinch to go through the pockets as well.

We're just as thorough when it comes to refining our Gulfpride Oil. We know the ordinary methods used on all oils shake out a lot of carbon-formers. *But* we use *also* the famous Gulf-exclusive Alchlor process. This refining miracle digs down far deeper into the choice 100% Pure Pennsylvania and comes up with plenty more sludge and dirt.

That's why Gulfpride gives you more lubricating power per drop—more protection for your motor. It's as clean as the old man's pockets.

FOR THE MATH-MINDED

J. L. Centanni, of New Orleans, tied this month's problem to a spare wrench and dropped it from a confusing altitude into T. W. T.'s right-hand desk drawer. Confidentially, we had to use the wrench to help solve it.

A big airport's hangars house 200 planes—some two-seaters and some four-seaters. The total number of seats is 464. How many two-seaters, and how many four-seaters are berthed on the field?

(We can't forward the wrench to you. But hurry your answer in to "Tattered Wing-Tips" and we'll check it with the official one.)

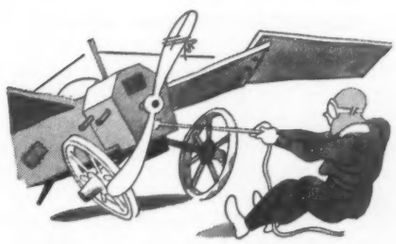
THIS MONTH'S WHOPPER

Dear Wing-Tips:

Here's one I'm swearing to on a stack of fish stories and Chamber of Commerce brochures.

About three years ago I got me one of those little gasoline, washing-machine motors and built me an airplane, using orange boxes, burlap bags, clothes-line wire, and a pair of old buggy wheels.

Well, sir, finishing time comes and goes and then comes testing time. I gets my creation out to the airport, dumps in some ordinary gas, and flips the prop over till she takes. Then when the motor is warmed up good, I hops in and opens her up. But she won't budge!



I gets out behind and poooshes—she won't budge!

I gets out in front and poooooooollllss . . . she still won't budge!

After a time she's out of gas so I go over to a different pit and come back with a cupful of G. A. G. 'Course I wouldn't have put in more'n a few drops if I was to foresee the future. But not being a prophet, I dumps the whole cup in the tank and flips the prop.

Well, sir, that plane done the strangest thing! IT JUMPED INTO THE AIR LIKE A SHOT-GUNNED RABBIT AND WAS GONE! Just like that!

That was three years ago and I didn't see hair nor hide of my baby till the other day when I was visitin' around over to the airport. All of a sudden that flying orange crate comes bustin' out of the sky followed by a coupla eagles, a condor, two or three falcons, half a dozen assorted hawks, and the toughest-looking humming bird you ever saw. In no time at all the whole flight banked in to a landing and taxied up menacingly to the GULF AVIATION GAS PIT!

Yes, sir, Major, that truant crate finally run outa' gas and dropped in with the mob for more of the same!

Kenneth Reid

Gulf Oil Corporation and Gulf Refining Company . . . makers of

GULF AVIATION PRODUCTS

Planning for Production

(Continued from page 35)

like to have plenty of flexibility and love to break the rules. Flexibility must remain in development and experimental work but once in production at competitive prices we must have better control with less interference. This means sales and engineering as well as the factory; yes, and even the customer will have to realize that change in design, materials or tools is a costly undertaking not only in money but in the use of key personnel who may be used to better advantage. Barring the question of safety, which can never be neglected, interference with production through non-essential refinement is detrimental and it is better to save such items either for repetition orders or new models.

I believe in extensive use of tools and equipment but based on policy and planning; no promiscuous buying at the first sales talk. Work on a budget; coordinate your equipment plan with all concerned including engineering. Precede selection and purchase with research because it pays to go a long way to see new equipment in operation and determine its adaptability to your particular needs. I suggest an obsolescence policy, trade in old equipment after careful study and, of course, on the basis of a good deal.

Equipment

There have been many discussions as to the merits of this or of that piece of equipment. As a general policy I believe in variety and feel that no single type fills all the needs. Going too heavy on investment on the basis of one method or one process may cause stagnation and of necessity retard the adoption of new mechanical developments and inventions. I often wonder if in our plans and estimates we consider the importance and cost of handling equipment. It is no longer a local shop problem but again a job for the specialist. In the U. S. aircraft industry it has been somewhat the tail of a kite and I feel that more study before subsequent action will pay dividends. Carriages and stands should be designed in a manner to readily adapt them to a variety of models and at the same time provide for easy disassembly for temporary storage. We are not yet ready for such extensive materials handling equipment and conveyors as in mass production plants but it is time we got started and I recommend research and gradual application in actual production.

Tool Storage

Tools and equipment storage is of sufficient consequence to demand a definite policy and good control. With spares requirements, possible for five years after an airplane contract, multiplied by a variety of types and models which most companies go in for, I wonder if the subject has received enough attention. There usually are records and some sort of plan for control but the progressive discarding and rearranging according to obsolescence or change and their probable utility as a fixed plan through sales, engineering and planning is not generally the rule.

Overhead

I believe that as we progress the tendency is for more indirect or so-called overhead expense. More equipment, power, better lighting, higher taxes, planning and control all add to the burden. What the proper ratio of burden to direct labor should be is highly speculative and depends on organization setup and company policies. I believe that the upward trend is inevitable but sound. It is also elusive and bears continual watching. Tangible results of direct labor can be fairly well measured but the results of overhead policies can only be gauged by results over a long period of time. It is a difficult problem for management and whenever additional overhead in some form or other is contemplated certain questions should be answered. Is additional overhead needed because of a fundamental change or improvement with ultimate returns on the investment or is it a duplication of effort and because of inefficiencies somewhere down the line? A sound analysis, recognition of facts and good judgment are essential requisites in guiding an organization on overhead control.

Financing Air Transports

(Continued from page 29)

lines a few planes for a temporary period.

The "Philadelphia Plan" or lease agreement generally used in the railroad industry and as applied for the first time in the aviation field by Pan American Airways, is believed to be the most feasible from the viewpoint of the investor and borrower. In addition to the features of the Pan American financing previously indicated, an important protective factor for the investor is the advance rental payment for the equipment, which provides an initial margin of safety. Moreover, the serial payments of the carrier to the trustee for the purpose of retiring maturing certificates gradually increases this margin of safety as the annual retirement of outstanding certificates ordinarily more than offsets the actual depreciation of the equipment itself. Should any default occur in the payment of installments due, the trustee may not only take possession of the equipment but could also release or otherwise dispose of the planes in such manner as may be considered most beneficial to the holders of the trust certificates.

Significant too, was the Interstate Commerce Commission's report on sinking funds issued this year, which showed that, had the railroads used the sinking fund principle more extensively, they would have avoided many of their present day ills. Although, the ICC was primarily referring to railroad debt, other than equipment obligations, the principle involved is the same. The gradual but systematic amortization and retirement of debt is not only feasible but is conducive to sound financial practice.

Other transportation agencies have also successfully financed their equipment acquisitions based on the principle of gradual retirement of debt and on a "pay-as-you-go" basis. For example, the Campbell Transportation Company, a barge line operating on the Ohio & Mississippi, issued equipment notes under the same "Philadelphia Plan" with provision for serial maturities over a ten year period. In the field of motor bus transportation,

(Turn to page 82)

What happens —AT 50° BELOW ?

In their first year of service Hydromatic propellers have established an enviable reputation for satisfactory cold weather operation. . . . In anticipation of still more severe demands, Hamilton Standard has added a Cold Test Room to its facilities. In this room complete propeller installations are being tested under closely controlled conditions to insure efficient and dependable operation at extremely low temperatures.

HAMILTON STANDARD PROPELLERS

One of the three divisions of
UNITED AIRCRAFT CORPORATION
EAST HARTFORD, CONNECTICUT

(*Continued from page 80*)

the operating subsidiaries of the Greyhound Corporation, made substantial additions to their fleets through the use of equipment mortgage notes. These notes were secured by a chattel mortgage on the motor coaches and equipment. All of these notes provided for quarterly serial payments, and for the most part, were to be retired over a five year period. The important feature in both of these cases, was the recognition given the limited life of the equipment purchased. Accordingly, ample measures were taken to assure the liquidation of the obligations incurred long before the expiration of the probable useful life of the equipment so acquired.

Equity financing perforce, is not only an expensive method of raising capital but is particularly unsound as a source of funds for new equipment purchases. As airplanes have a useful life generally limited to five years, annual provision from operation income must be made during this period for depreciating this equipment. Unfortunately, this alone falls far short of realizing the ultimate aim of creating a Reserve for Depreciation account. For example, the Sinking Fund device is frequently employed for the retirement of bond issues. The establishment of a Reserve for Sinking Fund is entirely meaningless without the creation of a contra Sinking Fund asset account containing cash or other assets. The Reserve for Sinking Fund may prevent the company's earnings from being siphoned out in the form of dividends or for other projects. However, it is the Sinking Fund proper which becomes the vital force that pays off the mortgage.

In the same manner, particularly in view of the short life of airplanes, along with a Reserve for Depreciation of Equipment, a tangible asset account should be established to function as an Equipment Replacement Fund.

As a practical measure, American Airlines has applied this principle to very good advantage. Instead of establishing a cash Replacement Fund, American largely used "depreciation cash" to retire its indebtedness to the R.F.C. and is actually paying for its equipment as it goes along. As the useful life of these planes is gradually extinguished, no serious financing problem should confront the company in their replacement and the addition of new planes. It was primarily from "depreciation cash" and current earnings that the company was able to purchase 10 D.C.3's for cash earlier this year. Moreover, the prompt and advance payments made on the R.F.C. obligations should redound to American's credit standing and make this same source available for future financial aid if necessary.

Although, equipment trust notes appear to be the most feasible vehicle for financing new plane purchases, the all important principle is the provision for the gradual amortization and payment of the debt over the useful life of the equipment. Such sound financing procedure should save the air transport industry from becoming saddled with a top-heavy capital structure and from facing the same situation plaguing the railroads today.

Fortunately, the current earnings record of the air transport industry should greatly facilitate equipment trust financing. The industry as a whole reported profitable operations as early as May of this year contrasted to the period late in the third quarter for last year. This background of earnings should readily permit the initial down payment required on this type of financing. Moreover, the industry is in a strategic position to strengthen its financial structure and replace its equipment fleets. A more balanced capital structure can gradually be achieved with equity issues, i.e., capital stock, representing the working capital, and fixed assets and equipment notes for the most part supporting the "flying" assets.

The railroad industry, which appears to be in a declining stage, is able to finance its equipment acquisition with little difficulty by selling trust notes at reduced interest rates. There is little reason why the air transport industry, still in the strong upward phase of its growth cycle, can not advantageously do likewise and finance its plane purchases with a minimum cash outlay and at a low interest cost.

Magnesium Sheet for Aircraft

(*Continued from page 37*)

Pickle solution followed by a rinse with cold and hot water. It is particularly important that welds be designed so that flux is not trapped and because of this fact, lap welds especially should be avoided.

In assembling magnesium alloy parts into an airplane, it is important that these parts should be suitably protected or insulated where two surfaces come in contact. This is particularly true if the magnesium alloy comes in contact with a dissimilar metal or wood. The magnesium alloy contact surface will, of course, be surface-treated as described earlier in this paper, but in addition, zinc-chromate primer, sealing compounds or gaskets should be used in the joint. The choice of these materials depends upon the conditions encountered. Suitable sealing compounds and gaskets are available and specific recommendations can be given by the magnesium suppliers.

After assembly, magnesium alloy parts should be painted wherever possible and Army and Navy specifications covering painting and finishing material for aircraft use have been found satisfactory for magnesium alloys. For exposed surfaces it is recommended that one coat of primer be used followed by two or more finish coats. Below is a list of the Government specification numbers of suitable primers and finish coats for magnesium alloys.

Primers

1. U. S. Army Specification 14080 (air dry, or bake 1½ hours at 160°F.)
2. Navy Aeronautical Specification P-27 (air dry or bake 1½ hours at 160°F.)

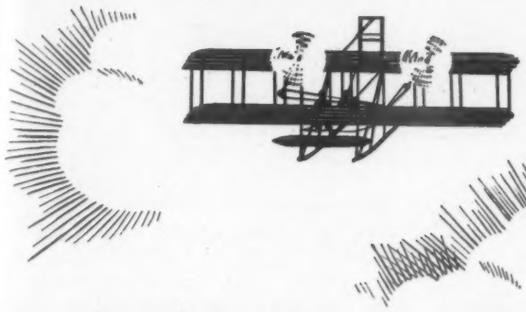
Finishes

1. U. S. Army Specification Varnish TT-V-121a plus 1½ pounds aluminum pigment per gallon.
2. U. S. Army Specification Enamel 3-98-C.
3. Navy Aeronautical Specification Varnish V-10 plus 1½ pounds aluminum pigment per gallon.
4. Navy Aeronautical Specification Varnish V-11 plus 1½ pounds aluminum pigment per gallon.
5. Navy Aeronautical Specification Enamel M-67.
6. Navy Aeronautical Specification Enamel E-5 or E-6.

All finishes listed are normally air dried, but have been successfully force dried for one hour at 225°F with improvement in finishing time and performance.

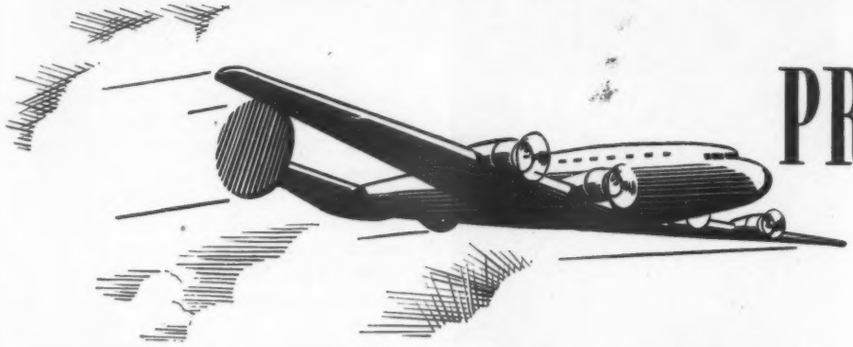
A satisfactory heat resistant engine enamel is covered by U. S. Army Specification 3-135.

PESCO draws upon experiences of the



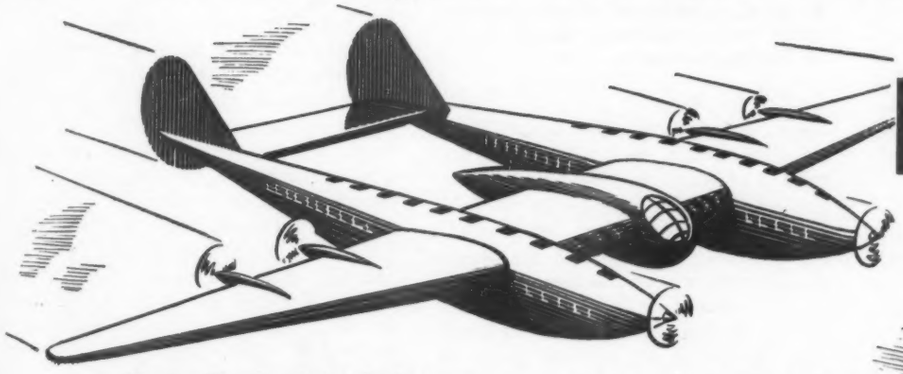
PAST...

to build the best possible products for the



PRESENT...

and to anticipate aviation's needs for the



FUTURE

Pesco Products include: **Fuel- Vacuum- and Hydraulic- Engine Driven and Electric Motor Driven Pumps • Suction Relief Valves • Safety Valves • Check Valves • Oil Separators • Accessory Drive Gear Boxes • Pressure Relief Valves • Hydraulic Motors • Hydraulic Cylinders • Hydraulic Pressure Accumulators • Hydraulic Control Valves • Hydraulic Locks • Propeller Anti-Icing Pumps • Propeller Feathering Pumps • Combination Vacuum and Hydraulic Pumps • Special Aircraft Products Built to Customers' Specifications**

CONTRACTORS TO THE U. S. GOVERNMENT FOR APPROVED AIRCRAFT ACCESSORIES

PUMP ENGINEERING SERVICE CORPORATION

DIVISION BORG-WARNER CORPORATION

12910 TAFT AVENUE CLEVELAND, OHIO, U. S. A.

S.A.E. Talks Production

(*Continued from page 33*)

the aircraft industry; Ed. G. Budd Mfg. Co., stainless steel parts and accessories; Cannon Electric Development Co., quick-detachable multi-circuit connector plugs; Ducommun Metals and Supply Co., aircraft hardware; Fafnir Bearing Co., a complete line of aircraft bearings; International Nickel Co., stainless steel; Librascope, Inc., balance and power computers; Edw. D. Maltby Co., Federal aircraft bearings; Norma-Hoffman Bearings Corp., aircraft bearings; Pyrene Mfg. Co., fire extinguishers; Rohm & Haas Co., Inc., Plexiglas in various forms; S.A.E., membership display; Solar Aircraft Co., exhaust manifolds, steam heating system; SKF Industries Inc., aircraft bearings; United Aircraft Products, Inc., parts; Wright Aeronautical Corp., engine display. J. H. Kindelberger, president of North American Aviation, Inc., acted as chairman of the aircraft engineering display committee.

General chairman for this year's production meeting was Mac Short, president of Vega Airplane Company. Short was long on attention to details and the sessions went through without a hitch. In addition to the general excellence of the papers, and their extreme timeliness from a production standpoint, was the unusual extent to which the sessions were illustrated. In addition to the customary slides the audiences were treated to a number of fine industrial moving pictures, some of which were presented with sound.

Dr. A. L. Klein, California Institute of Technology, was chairman of the first session, on Thursday morning, which got away to a flying start with the paper on Propeller Production, given by Arvid Nelson, Hamilton Standard Propellers. Nelson took his hearers through the development of propeller manufacture from the hand methods originally used to the present extensive machine methods which have resulted in a vastly improved product at reduced cost. He discussed in detail the latest methods of shaping, broaching, milling, etc., as developed by Hamilton Standard. This talk was illustrated both with slides and with motion pictures. While Nelson's paper dealt with propeller manufacture, most of the machine processes he outlined could find application in many other phases of aircraft and aircraft engine production. For example Nelson showed how turret lathe work had been speeded up by using a color system to identify each tool with the toolholder. An example of reduction in machine time was given with a slotting operation performed on a vertical

S. A. E. engineering exhibit showing crowd interest in hydraulic display board of Aircraft Accessories Corp.

shaper in half the time previously used on a horizontal mill. Much of the growth of Hamilton Standard, and its present important position in the field of propeller development and production, should be credited to the intensive development of machine manufacturing methods, Nelson said. He pointed to the growth of the company from 25,000 sq. ft. of floor space to more than ten times that amount, and from 65 employees to the present total of more than 1200, as evidence that efficient machine methods create jobs. So comprehensively was this subject treated that no discussion was evoked.

Not so, however, with the paper on Airplane Brake Installation and Control Considerations, by Henry H. Kerr and F. C. Frank, of the Bendix Products Div., Bendix Aviation Corp., read by Kerr. This paper dealt with the phases of brake design most closely concerned with proper control, and with service difficulties. Factors such as axle stiffness, play between the brake and landing gear, the two types of hydraulic fluid, proper sealing members, hose sizes, etc. were all discussed in detail, with reference to mathematical formulas that had been found satisfactory as a guide in designing brake systems. Several questioners popped up from the audience at the first opportunity to ask about the effect of drum irregularities, what portion of the coefficient of friction of the tires could be used, etc. Kerr replied that it was desirable to cool the drums as much as possible to avoid the results of overheating caused by irregularities, and other factors. He thought danger of nosing over through full application of brakes depended entirely upon the particular conditions and the individual airplane, pointing out that wheels may be slid with brakes fully locked under various conditions, as on a surface made slippery by water, or at the first part of the landing run when much of the plane's weight is still borne by the wings. Dr. Klein suggested that axles threw a heavy load on the wheels themselves if axle deflection occurs. Kerr felt that wheels lend themselves well to such stresses and knew of no cases where bearing failures had occured as a result. C. E. Stryker reported that total deflection of the DC5 axle was 1½ deg., including such deflection as takes place in the strut.

A prophetic discussion of "high pressure" hydraulic systems was presented by Harold W. Adams, Douglas Aircraft Company. Defining a "high pressure" system as one employing pressures above 2000 lb. per sq. in., Adams found many advantages for such a system, especially on large aircraft, and felt that the high pressure type hydraulic system would find wide adoption. Chief result of the use of a properly designed high pressure system is to effect a substantial weight saving. Also, the lines and fittings are smaller and easier to install and service. Machine work must be more accurately done, but this is made easier by the heavier sections employed, with the result that costs of machining about balance for both systems. Danger of high pressure systems was felt to be little greater in the event of failure, as parts are smaller and would have less inertia if thrown through the structure. The author felt that the problems of high pressure systems are primarily design problems, which stay solved, rather than shop problems, which are always with us. In a prepared discussion by J. W. White, chief engineer, brake

(*Turn to page 86*)

FOR THE GREATER
PAN AMERICAN SYSTEM

•

Only four months ago the dream of regularly scheduled transatlantic air passenger service became a reality. With the introduction of the big Boeing 314 Clippers and the materialization of Pan American Airways' carefully-laid plans, the North Atlantic at once became a standard commercial air route. Service over this route is now being carried on as a routine operation.

The recent order for a fleet of six additional Boeing 314's to increase schedules on both the Atlantic and the Pacific, expresses far better than words the traveling public's acceptance of these ships and of the Greater Pan American Service.

•

Boeing has always built tomorrow's airplanes today!

BOEING AIRCRAFT COMPANY · Seattle

(*Continued from page 84*)

and hydraulics division, Bendix Products Division, problems of a suitable pump for high pressure systems were discussed in detail. Adams agreed that the pump is a real problem and thought it would be solved by a pump of positive displacement somewhat similar to Diesel fuel pumps. Considerable discussion came from the floor with respect to possible advantages of the high pressure system. Adams pointed to a saving of approximately 600 lb. through use of a high pressure hydraulic system on the Douglas DC4 as compared with best design practise on a suitable system using standard pressures.

C. E. Stryker, chief engineer, Bendix Company of Calif., acted as chairman for the Thursday afternoon session. Opening paper by Courtney Hertel, Douglas Aircraft Company, dealt with "Interchangeability in Modern Aircraft Production". This subject was treated primarily from the standpoint of large structural parts, such as portions of the wings and fuselage, and the problem of transferring dimensions from the loft boards to the production line in such a way that accessories and other units may be fitted to the parts of the plane where they mount, without additional fitting on the spot. Since no two men will scale the same exact dimension from a loft drawing it is necessary to use the loft layouts just once, for the development of a set of mathematical tables representing points at percentage lines of wing and fuselage. These tables of coordinates are thereafter used by all branches of the shop for developing jigs, fixtures, etc. Extensive use of the hydraulic press in securing uniform production and full inter-changeability was outlined.

Production came into its own in the discussion of The Final Assembly of Aircraft, given by H. F. Schwedes, North American Aviation, Inc. Schwedes spoke entirely from a series of slides showing pertinent portions of the North American factory. He pointed out that North American holds a peacetime production record for any major aircraft builder by turning out 103 complete airplanes during 23 working days of the month of August, and by averaging 74 airplanes per month for the first six months of 1939. Schwedes also disclosed that North American had assembled ten airplanes during one 24 hr. period recently. Primary factor in securing efficient production, Schwedes said, was for the engineering department to be production minded. This has been accomplished at North American through a remarkable degree of cooperation between the design section and the shop supervisors. Major factor in accomplishing large scale aircraft production, the author felt, was to break the production unit up into the maximum possible number of parts or subassemblies. This permits all primary work to be done without crowding, and, if proper jigs are used, the final assembly line then becomes a simple procedure of attaching completed units to the plane as it progresses along the floor. Much credit for North American's smooth production must go to the detailed production control system. This is based on a lot system by which contracts are broken up into units releasing 20 airplanes at a time, except for the first trial lot, which is usually for five to ten airplanes to permit the shop to check all tools, jigs, etc., prior to heavy production.

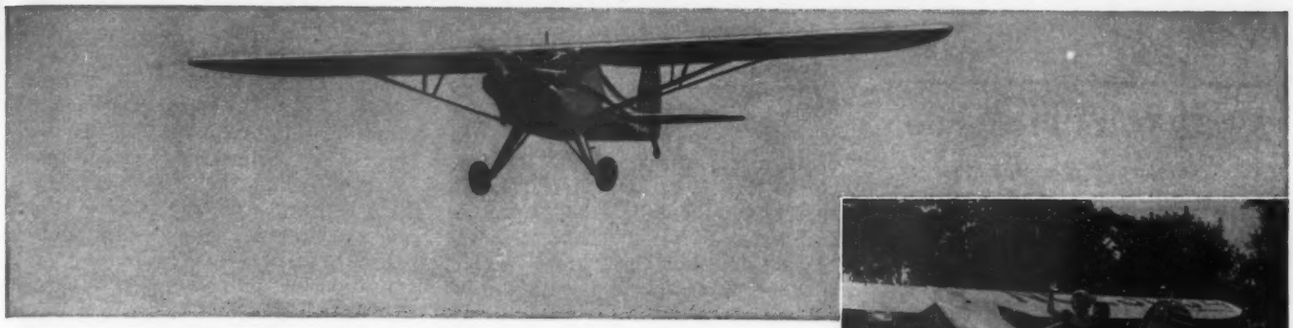
P. N. Jansen's paper on "Accelerated Aircraft Production for National Defense", (Reproduced in part on page 34) was read by T. P. Wright in the absence of the author. Wright did not read the entire paper, but commented on it generally. He felt that great emphasis should be placed on production of the prototype under pressure, as suggested by Jansen. He also thought that the mock-up idea could be further extended into preliminary design and production phases. Written discussion submitted by Ralph Damon, American Airlines, emphasized need of further attention to inventory control. Damon thought that aircraft factories keep too much of their financial reserves tied up in inventory; that inventory turn-over should be not less than twelve times a year, instead of two to four as at present. Discussion from the floor elicited the comment from Dr. A. L. Klein that installation of equipment in a plane is a much greater production problem than constructing the basic structure. For this reason Klein thought that emphasis on simplified structures, such as molded planes, may prove to be misguided due to the resulting problems of accessory installation.

Display of Federal Aircraft Bearings installed by E. D. Maltby Co., Calif. distributors. L. to R.—Fred C. Warren, E. D. Maltby, George A. Banton.

The development phase of production received attention at the Thursday evening session, with T. P. Wright acting as chairman. W. A. Hite, Vultee Aircraft, gave his paper on "Engineering Experimental Aircraft", in which he disclosed that the new Vultee Trainer, which has been ordered in quantity by the U. S. Army Air Corps, was flown exactly 88 days after the first engineering work commenced. Hite emphasized that production engineering did not suffer from this speed of development, as the plane was also laid out for the simplest possible production procedure. In this connection every effort was made to obtain shop suggestions prior to and during the course of design work. Indicative of the astonishing structural simplification in the Vultee Trainer is the fact that all spanwise wing stringers, or stiffeners have been eliminated, and that aileron, flap, and control surface ribs have been eliminated. Control surface ribs are eliminated through use of formed flat sheet with stiffness obtained by beads and flanges, the unit being fabric covered. The chairman questioned simplified engineering of the prototype, feeling that it might result in slower translation of the design into production. Hite said this problem had been solved through the close coordination of shop and engineering department at the time the prototype was being developed. It was also found economical to use the drop hammer extensively during experimental work.

Hearers began to feel happier about America's position in the field of military aircraft development after hearing Hite's explanation of how Vultee developed the trainer model in less than three months, and this feeling was clinched when B. W. Sheahan, of Consolidated Aircraft Corp., told how Consolidated developed the Model 31 in less than ten months, an

(*Turn to page 108*)



FOR LASTING SATISFACTION BUY A LUSCOMBE

Durable ALL METAL construction, using preformed and predrilled parts, makes possible a safe sturdy plane which will outlast conventional types. Because of its light weight and beautiful lines a Luscombe gives highest performance—104 cruising, 350 mile range, 900 feet-a-minute climb. Extra refinements at no additional cost such as ball bearing controls, rich upholstery, low nose for exceptional visibility, and two wide doors, afford greatest comfort and give the owner a feeling of luxury found only in ships priced remotely higher.

For greatest value, performance, and lasting satisfaction, your best buy is an ALL METAL Luscombe. Priced from $1895, with terms as low as $633 down. See and fly one now, there is a dealer near you.

LUSCOMBE 50—$1895; 65—$1975, SEAPLANE—$3170

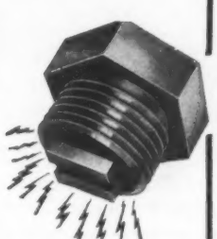
ALL METAL *Luscombe* SAFETY

For folder and further information see your dealer or write Dept. N

LUSCOMBE AIRPLANE CORPORATION
West Trenton, New Jersey

MAGNETIZED DRAIN PLUGS

for Aircraft Engines



Powerful Magnetized Drain Plugs installed in oil lines remove abrasive metal particles from the lubricant—prevent excessive wear to fine bearings—reduce maintenance costs. Regular equipment on many aircraft engines. Magnetized Plugs guaranteed to retain power for 5 years. Every aircraft engine should have this low cost protection. Write for attractive offer.

LISLE CORPORATION, Clarinda, Iowa

B★A★30

B★A★30 airplane wing cloth is lighter, stronger and more closely woven than other airfoil fabrics. Inquiries from dealers and manufacturers will receive prompt attention.

WELLINGTON SEARS COMPANY 65 WORTH ST. NEW YORK CITY

IRVIN Air Chute
The Life Preserver of the Air

STANDARD type equipment for the Air forces of over 45 Governments including those of the United States and Great Britain. "Irvin" has proven its dependability over a period of 20 years.

The World Famous Caterpillar Club

has over 3000 Members whose lives have been saved with standard IRVIN Parachutes.

IRVIN CHAIR CHUTES
for Cabin Planes, for personal and business use.

Everywhere aviators and test pilots depend on it.

Consult our engineers on your chute problems.

IRVING AIR CHUTE CO., INC.

1670 Jefferson Ave., Buffalo, N. Y.

FACTORIES AT: Buffalo, N. Y.; Glendale, Calif.; Fort Erie, Canada; Letchworth, England; Bucharest, Rumania; Stockholm, Sweden and other countries.

S.A.E. Talks Production

(*Continued from page 86*)

astonishing record for such a huge plane. The Model 31 is a twin-engined flying boat powered with two of the new Wright Duplex Cyclone engines of 2000 h.p., and is generally credited with an all-out range of about 10,000 miles and a top speed in the neighborhood of 300 m.p.h. The plane was built at the expense of the Consolidated company as a private project which might be converted to either commercial or military specifications. Therefore the problem of accessories and equipment installations was given little consideration in early stages of the design, every effort being made to get the airplane in the air as a flying unit. However, accessory problems were not neglected, but were carried forward concurrently with the airplane design proper. A major speed-up resulted from working directly off drawing boards. Drawings were cut to about one-third the normal number and all working drawings were laid out directly on loft boards which were then, in most cases, transferred directly to the shop for use as jigs and templates. Photographs of the loft layouts serve as permanent records, and for reference purposes of all sorts.

A detailed progress report on the development of in-line, aircooled engines was given by A. T. Gregory, chief engineer, Ranger Engineering Corp., showing that the Ranger six-cylinder engine has been developed to give 50 per cent greater horsepower within the past five years, with equivalent reduction in weight per horsepower. It was shown that manifold design depends on a careful study of the harmonics of pressure waves within the intake manifold, a proper selection of length and diameter resulting in a supercharging affect. A detailed report on valve gear and camshaft development was also made. An indefinite life for all valve gear parts except the spring has now been achieved, practically through application of needle bearings to the rocker arms. Extensive experiment and mathematical analysis has made it possible to locate the critical speed of camshaft vibration outside the operating speed range of the engine, with consequent improvement in service life of valve gear and drive.

Major problem in the quantity production of aircraft engines is the proportionately high number of changes made during production, an average of 10 changes for every 18 engines produced. Origin and nature of such changes was discussed, with the conclusion that more benefit results from speeding up the design change process than from trying to choke it down. Several outstanding recent design changes were described, such as the oil scavenging annulus which has been incorporated in the front and rear walls of the Cyclone G.200 crankcase resulting in a higher rate of oil flow with better scavenging. Progress in the design of a forged steel crankcase was outlined. The present case is as light, and as cheap to manufacture, as the alloy case it has displaced, and has proved much more satisfactory in service. An astonishing development is the reversal of the piston skirt oil scraper ring, making it a "pumper". Result is better lubrication of the cylinder walls. Precautions to prevent oil getting past the upper rings has actually reduced oil consumption. Other design changes were noted, such as the spikes forged on the under side of the piston head for cooling, the coil spring piston pin retainers, the new end sealed master rod bearing which improves oil flow through the rod system, and the new automatic self-cleaning oil filter.

A report by O. C. Bridgeman on the C.F.R. Vapor Lock Project, indicated that vapor lock, while not a problem at normal operating altitudes of 5–10,000 ft., becomes a very real problem at 20,000 ft. or more, and is of vital importance from a military standpoint. No conclusions have been drawn as yet, but Dr. Bridgeman indicated that the solution might be found in use of fuel coolers, in conjunction with a supercharged fuel system to keep the fuel under pressure in the tank, lines, pump, and carburetor

A look into the future was given the Friday afternoon audience with presentation of two papers dealing with submerged engine installations. The paper on problems of submerged engine installations, prepared by Wellwood E. Beall and E. G. Emery, Jr. of Boeing Aircraft Company, was read by N. B. Moore, in charge of Aeronautics Department, University of California. This paper presented a discouraging array of problems requiring solution before submerged engines may be adopted. Benefit of such installations was reported as a speed increase of about 7 or 8 per cent on the basis of calculations that have been made. The four major problems were summarized as: 1. Development of satisfactory propeller extension shaft. 2. Safe disposal of exhaust gases. 3. Overall cooling of the engine compartment, including oil cooling, accessory cooling, exhaust disposal system cooling, etc. 4. Mounting of the engine, especially with respect to possible engine or propeller failure. Discussion raised the question of application of present types of long-nosed radial engines to submerged, or partially submerged mountings in the fore part of the wing. T. P. Wright reported seeing such an installation in England on the Blenheim bomber. Propeller shaft extension was 14 in., and cowl improvement was so great that one would estimate a performance gain of at least 5–10 miles per hour. Yet careful tests showed no gain whatever. However, use of propeller hub cuffs on the Supermarine Spitfire brought a gain of 10–12 mph.

Discussing propeller requirements for submerged engine installations, George W. Brady, Curtiss Propeller Division of the Curtiss-Wright Corp., named two primary problems as improved aerodynamic treatment of the propeller hub shanks, and suitable structural support for the extension shaft. Vibration of the propeller-shaft-engine system is a major problem, but with the propeller mounted independently of the powerplant it may be possible to so greatly reduce propeller vibration as to make a reduction in propeller weight practicable. This weight saving could then be applied to the propeller drive and structural mount, reducing the overall increase in weight otherwise to be expected from use of such a system.

Brint Edwards served as chairman of the final session of the meeting, on Saturday morning, at which two papers were presented dealing with the light alloys of magnesium and aluminum. L. B. Grant, of the Dow Chemical Co. said (see also p. 36) that advantages of magnesium alloys to aircraft production were so great that only shop inertia could be responsible for failure to make wider use of the material to date. Europe is much ahead of us in this respect, customarily making much wider use of the material than in this country.

In discussing aluminum, G. D. Welty, Aluminum Company of America, presented a detailed history of the development of aluminum. He conceded that magnesium alloys, stainless steel, and plastics had all made inroads on the field of application of aluminum alloys, but felt aluminum is not yet at the zenith of its usefulness and will continue to be a major factor in aviation, and in industry generally for many years to come.